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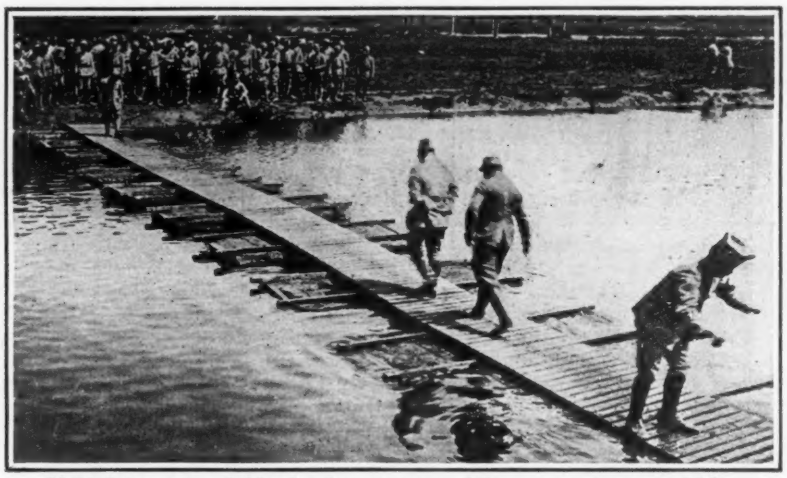
Light pontoon bridge for spanning diminutive waterways, consisting of several layers of cork held in a wooden framework



Light-duty pontoon bridge in place over one of the many waterways which cut up the Flanders theater of war

Fighting Flanders Mud—and the Germans

SO much has been written about the various offensives and engagements which go to make up the Battle of Flanders now being waged between British, French and Belgian troops on the one hand, and Germans on the other, that the mention of Flanders immediately suggests mud. For every report from that front tells of the struggle of the Allied soldiers with the thick, sticky clay which is so characteristic of this terrain. The Battle of Flanders might well be called the Battle of Mud; after all, mud is the main concern of the British and French troops, since a preponderance of artillery automatically takes care of a significant portion of German fighting spirit.

Where the terrain is dry and firm, modern fighting is largely a matter of intense artillery preparation, followed by carefully coördinated barrage fire and infantry assault. But where the terrain is a bog, the infantry, irrespective of the artillery preparation, is at a tremendous disadvantage. In recent battles the British infantrymen in Flanders have been unable to keep up with the methodically advancing barrage curtains, with the result that in some cases the casualties have been somewhat more severe than warranted by previous experience. Correspondents have told us of the British infantrymen sinking to their hips, and even to their neck, in mud, and of companions being obliged to pull some less fortunate Tommy out of a sinister mud hole. Indeed, in walking over this terrain the infantryman lifts one leg high into the air, and after placing it again on the ground he does the same with the other. The procedure, at a distance, resembles a form of dance, which is all the more pronounced when the men sway slowly from side to side, as they must do, to free themselves from the sticky mud.

Aside from the fact that the soil in some places is naturally sticky, the deplorable state of the Flanders terrain is largely due to concentrated shell fire. The churned earth, with its many shell holes, serves to hold such water as comes in contact with it; so that every rainstorm leaves the countryside a veritable sea of mud.

Besides being sticky, there is a far greater difficulty presented by Flanders mud—more than that, a positive danger—in the very softness of the ground. There is no firm footing to be had, and men and equipment sink deep into the mire. In some instances men have been drowned in the mud before help could reach them, especially at night when in utter darkness infantry has made its way over miles of bog to the actual battle line. Much equipment, particularly boots and other footwear, are lost in the Flanders mud.

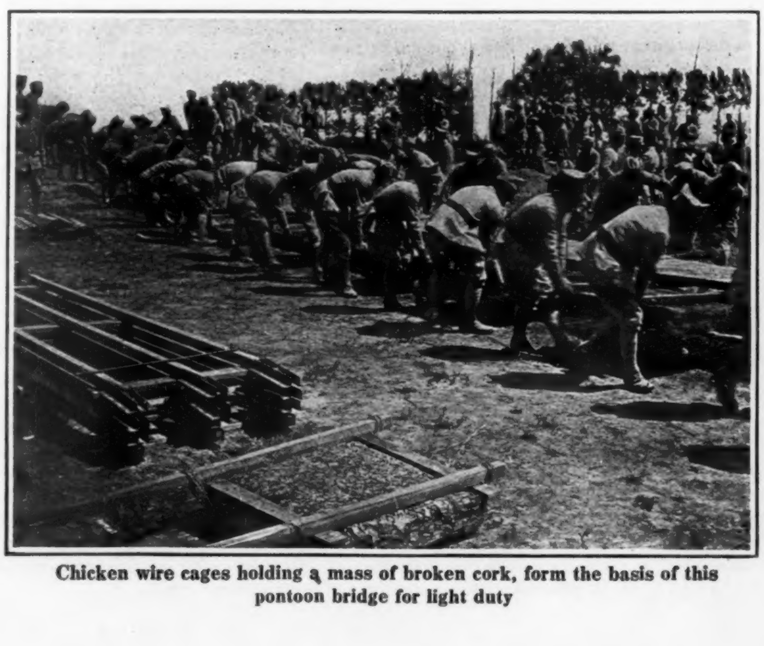
A most effective means of combating Flanders mud is presented in the so-called "duck board," used by the Allied troops in preparing approaches to the front-line positions. Duck boards are nothing more than short lengths of board walk which can readily be carried by the infantry and engineers. Because of the extensive surface which they present to the muddy terrain, the slatted walks do not sink and therefore offer a firm, solid footing for the soldiers. It is understood that mile after mile of duck-board paths are laid behind the Allied line in Flanders; and as a daily diversion the German artillerists endeavor to locate and destroy these causeways over the sea of mud.

Aside from mud, Flanders is remarkable for its numerous brooks, creeks, canals, rivers and other waterways. Practically every Allied offensive means crossing one or more of these diminutive waterways. For this purpose there have been introduced novel pontoon bridges that take the place of the usual heavy structures, and that are of ample capacity for the use of infantry only. French engineers, in particular, have developed two kinds of light-duty pontoons, one consisting of a number of thick layers of cork strapped to a simple wooden framework, and the other comprising chicken netting filled with broken cork, also held in place in a plain wooden framework. In the usual manner, these pontoon units are lined up and a walk, consisting of slatted flooring, laid across them. The convenience of these light-weight, inexpensive pontoon bridges is at once obvious when one compares them to the heavy, expensive boat units used in spanning a wide river.

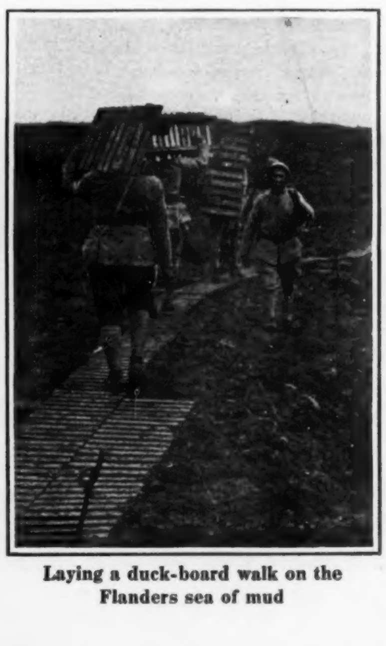
Flanders mud, fortunately, knows neither foe nor friend: it hinders the Allies and aids the Germans, and again, it aids the Allies and foils the Germans. While an offensive is being undertaken the mud is a serious obstacle, and it requires almost superhuman effort on the part of the infantrymen to cross the muddy "No Man's Land." But when once the Allied infantry has reached its objective, the tables are turned and it is the Germans who are harassed by the mud, which now prevents them from withdrawing guns and other heavy equipment, and from organizing a quick counter-attack. For mud is to be found in back of both lines—everywhere—in this great Battle of Mud.

Where Germany Now Secures Her Copper

WHERE Germany is obtaining her present supplies of copper is a question of considerable interest. Before the war she obtained most of her copper from the United States, taking over one-third of our exports. She had a large stock at the outbreak of hostilities but this must long before now have been depleted. Since Germany has extended her sphere of influence it is probable some supplies are coming from other countries. The Serbian copper mines are now being intensively exploited by the Germans and Austrians, and good copper deposits are also said to have been found in Poland. Work has begun in lead and copper mines in Kielce, and in Miedziana, Lysa Gora, and Olkuss the methodical exploitation of these ores has recently been started.



Chicken wire cages holding a mass of broken cork, form the basis of this pontoon bridge for light duty



Laying a duck-board walk on the Flanders sea of mud

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Case of Italy

NOTHING short of a catastrophe of the first magnitude has descended upon Italy's armies. Of that there can be no doubt.

At the time of writing the mountain heights on the Isonzo have been lost to the Italians, the important railroad center of Udine has been captured and the invasion of the northern Italian plains appears to be well under way by the Austro-German forces pouring in through the mountain defiles. Whether or not the Italians will be able to check the invader on the Tagliamento line, which takes its name from the river flowing more or less in a north and south direction, remains to be seen. At any rate, the Italians are fighting well, remarkably well; their cavalry and other light units are conducting an effective rear-guard action with the Austro-German vanguards, while the bulk of Cadorna's forces are retreating in an orderly and masterful manner. But all this will be many days old before it reaches the reader, hence it is futile to discuss the military situation here.

What is of paramount interest just now to ourselves and our allies is the initial breakdown of the Italian forces. But a few weeks before, these same forces were storming mountain after mountain in their victorious march on Laibach on the one hand, and Trieste on the other. Austria, we were assured, was reduced to her last military resources; her resistance was fast waning and the end could not long be delayed. Italy, our advices continued, was the strategic Ally in the world war—the keystone of the situation; through Italy's efforts Austria was to be subdued, followed by the capitulation of Germany, when the arch enemy found himself alone in the fight against the greatest coalition of powers in all history.

The sudden change from a brilliant offensive to a sombre defensive, or from invader to invaded, requires explanation. And since all the facts in the case are not available and probably will not be available until after the war, it is necessary for us to piece together the various shreds of information gathered here and there, in order to form a whole explanation of Italy's sudden misfortune. This, then, we have attempted to do in the following:

The outstanding fact is that the Allies have again made the very same error which has figured in the Roumanian campaign, namely, they have overestimated the strength of their ally and have underestimated the strength which the common enemy could bring to bear against that ally's front. This has been an ever-recurring fault of the Allies. So it was that Italy was supposed to decide the war when she cast her lot with the Allies; Italy, we were told, alone was a match for Austria. When, as a matter of fact—and the Italians entertained no illusions in this connection—Austria was far too powerful a foe to be tackled single-handed. Indeed, we are told by Italian military authorities that the original plans called for a defensive warfare by Italy in order to wear down the Austrians, after which the troops of Savoia could dash forward irresistibly into Austrian territory. And this defensive warfare was to be carried out along the banks of the Tagliamento—the very same line which, at this writing, is being mentioned as Cadorna's defense line.

But Austria's Russian troubles caused her to concentrate her attention on the Eastern front. The Italians found themselves in the position of a superior force, and so they decided to advance their defensive line into enemy territory, exchanging the Tagliamento for the Isonzo. Again, things went well with them; and so they pushed on to the Bainsizza plateau and other lofty positions along the famous river. All the while, of course, they depended upon Russia to maintain the then-existing relative strengths of the Italian and Austrian armies.

Came the Russian revolution; the reign of terror in the new Republic; the advent of lax discipline in the Russian army, and finally the more or less complete breakdown of the Moscovite armed forces. Austria, aided by Germany, took advantage of the situation: entire armies, together with their artillery and other equipment, were shifted to the Italian front. Enormous forces, we are told, were launched against the Italians, thus resulting in the initial breech in that sinuous line of over 450 miles which rose and fell on mountain ranges.

The first point, then, is that Italy has been taxed far beyond her strength.

Then there is the matter of ammunition. Italy has neither iron nor coal of her own. So she has had to depend upon the United States and Great Britain for these prerequisites to modern warfare. And as wonderful as her industrial development has been, and as numerous as have been the extensive munition plants in various parts of the country, these have been entirely at the mercy of the iron and coal supply. We have first-hand information that the facilities for the manufacture of guns and shells were ample. But never has the raw material come in at the desired rate. Recently, some of the big plants have had to close several days a week because of lack of raw material.

Modern artillery imposes a terrible strain upon a country's industries. Big guns are seldom at rest, and hour after hour, throughout the day and night, they send their shells over to the enemy. Imagine, then, the plight of the Italian gunners when they only received their munitions in small lots. We are informed that shells and powder came up every day from the interior of the country to the advanced lines on lofty mountain summits, just the same as the daily bread. Never was there an accumulation of ammunition in the sense of the "dumps" in back of British and French batteries. We are further informed that there were days when guns in exposed positions were without ammunition—nothing was forthcoming over the splendid highways built by the Italians, and up the remarkable cable railways leading to the highest guns.

Then there were serious political dissensions in Italy. Of these we know little, except that the sudden military reverse has set these at nought; all parties are now united. But we do know that espionage was in full swing in Italy, attacking the armed forces of the kingdom from the rear, while the Austro-Germans were preparing their master stroke. The part that this espionage played must have been great. One instance alone is to be found in the fact that the initial Teuton stroke was delivered against the left wing of the Italian forces on the Julian front, where territorial troops held the trenches. So the Teutons knew just where the weakest point was, and struck there with tremendous violence.

Bare hands cannot fight modern artillery. The Russians tried it, so did the Roumanians and the Serbians. Now Italy has tried it. And they all have failed. So the Italian reverse is due, in large measure, to the failure to obtain iron and coal with which to turn out shells, more shells and still more shells.

The need of Italy just now is not men. She has ample soldiers with which to conduct a successful defensive and even undertake a smashing offensive at no far distant date, when the Austrians and Germans will be urgently required in some other theater of war. Italy needs iron and coal, and shipping in which to transport them. While France furnishes such aid as she can in the form of finished guns and shells, Great Britain and ourselves should not hesitate to furnish shipping and large quantities of iron and coal, not only now but in a continual stream. Never again must Italian guns be silent for want of iron and coal in the munition plants. And never again should the Allies overestimate the strength of a member of the coalition, and underestimate the striking power of the Central Powers.

We have been taught a lesson which must not be soon forgotten.

The 1918 Kitchen Garden

THIS is the time for stock taking in connection with the food situation. We have had a growing season which broke all records and was generally beyond expectations. The work of gardening, of canning and of drying vegetables and fruits has been under way in the land, from Maine to California, and from the Lakes to the Gulf, and has justified all belief as to success. It is important to consider what this means. It means one million one hundred and fifty thousand acres of city and town land under cultivation the past season for the first time. This area of productiveness embraced back yards, vacant lots and hitherto untilled tracts of land in and around nearly every city, town and village. A nation-wide survey located nearly three million such gardens. This is only a beginning. What shall the harvest be next year? What have we learned this year?

Germany reports that its town war gardens produced more in 1917 than in any year since the war started. This shows the value of experience. In our one year of experience, it is conservative to state, that by the planting of gardens the nation's food supply has been increased to the extent of more than $350,000,000. Next year we will do even better. We will then have more war gardens and the average production will be larger. With a better knowledge there will be fewer failures. Any inventory of the food situation must reckon this great garden fruitfulness as a vital factor. As its first duty, already accomplished, it has been of great value in keeping down the cost of living for the people of America. Household expenses have been bad enough as it is. That they would have been far worse without the garden crop is obvious. There is much evidence that our food gardens are helping our people to feed themselves more reasonably. Beyond question, this garden achievement has much to do with the fact that the increase in price of garden products in the year was only 22 per cent, or less than one-fifth the increase in the price of breadstuffs.

The glass jar manufacturers of this country have delivered during the season of 1917 about 119,000,000 glass jars. A survey of the household supply of jars used for canning and preserving in some twenty typical towns throughout the country showed that the housewives of America in 1917 used but one new jar to over three and one-quarter old glass jars which were already on hand. Thus it appears that in conservative terms the home women of our country put up nearly five hundred million quart jars of vegetables and fruits, certainly three times what had been accomplished in any season before. Next year, profiting by their experience of this year, they will can millions more, and more will be needed.

Much has been learned this year by town and city people about the cultivation of the soil in the interest of thrift and health, and also about the conservation of its products, so that we may look with faith and courage to still greater results for 1918 when the need will be more urgent. If 25 per cent of the new war gardeners failed, owing to inexperience to get a good crop this year, not 10 per cent will fail next year. People who did not plant this year have been so enthused with this nation-wide success of the home gardening and home canning movements that they will not be doing their duty to themselves or to their country if they do not do their share in 1918.

This war will be won in large part by fighting with food. We will do our duty in this hour of trial, and we have no greater duty than the production and conservation of food. Ambassador Gerard is unquestionably correct in his statement that we cannot starve Germany; but we can very easily starve our Allies if we are sufficiently short-sighted.

We are not wholly removed from the possibility of starving even ourselves. Much of the ability to prevent this lies in hands other than those of the individual householder. But the contribution which the householder can make through his garden is perhaps the biggest single factor. Last year we began very late in the season. This year we have ample time for preparation. Let us, therefore, begin today the work of making effective our 1918 campaign for food F. O. B. the kitchen door.

Industrial Research in Great Britain

THE advisory council to the committee of the British privy council for scientific and industrial research has recently rendered its second annual report. During the year there has been created an Imperial Trust for the Encouragement of Scientific and Industrial Research, which controls the sum of $5,000,000 voted by Parliament for research. An important undertaking of the council is the organization of coöperative research associations for various industries. The firms belonging to a particular industry will contribute to the expense of the investigations within their own field of activity and share in the results, and the research associations will also receive grants from public funds. Thus a research association for cotton is being organized. Its studies will cover the whole industry, from the cotton plant to the finished manufactured product. The members will include cotton-spinning, doubling and thread-making firms, cloth lace and hosiery manufacturers, bleachers, dyers, printers and finishers. The woolen and worsted manufacturers are forming an association for research, and so are the Irish flax spinners and weavers. Other associations to be formed in the near future will represent the photographic manufacturers, electrical engineers, Scottish shipbuilders and steel manufacturers, aircraft builders, piano makers, etc., etc. The National Physical Laboratory has been taken over by the research department from the Royal Society. A Fuel Research Board has been organized. A committee of inquiry has been appointed to sit in Dublin and consider the experience gained in Ireland in the collection and use of peat. Many other undertakings are on foot. Some of the tangible results already achieved in this great campaign of research under government auspices are the discovery of three kinds of optical glass, the invention of light alloys for use in aircraft, and the production of a new hard porcelain from purely British raw material.

Electricity

A Combination Heater-Stove.—Because the heating member is mounted on a pair of trunions, a recently-introduced heater can be used either as a radiator or stove. The heating element is placed in a copper reflector, and is readily removed so that all parts can be reached and cleaned. When placed in a horizontal position, the device is suited to general cooking, such as boiling eggs, making tea or coffee, toasting bread and other light grill work.

A Water Purifier Based on the Electrolysis Principle has been developed by an American concern. This device operates on 110-volt alternating current and direct-current circuits. It has a capacity of purifying 5 gallons of water at one time. The device is equipped with six feet of insulated cord and a two-piece attachment plug. With each purifier is furnished a special 2-gallon sanitary glass container in which to purify the water, equipped with a non-corrosive faucet for drawing off the purified water above the sediment.

Application of Radio-Active Salts to Batteries.—A recent French patent, due to a certain M. Thofehern, is concerned with the use of radio-active material for the purpose of facilitating the chemical action taking place in accumulators. For this purpose radium barium sulphate is suggested. The material is insoluble in the electrolyte, and does not appear to enter into chemical combination with the lead oxide or the metallic lead of the plates. Its presence, however, is assumed to render the chemical action more complete during charge and discharge; otherwise the process is normal. About 0.2 microgrammes of radio per pound of lead oxide is used, according to *The Electrician*, the radium compound being merely incorporated in the oxide used on the grid of the plates.

New Battery for Electric Pocket Lamps.—A dry battery for electric pocket lamps has been invented by a citizen of Zurich, Switzerland, according to a recent Consular Report. It is said to be cheaper, better, and of simpler construction than those now in use. Instead of a single block battery, it consists of three separate and distinct elements, which are placed side by side in the metal lamp case. The chief improvement is the possibility of substitution for a single element in case the battery is out of order. In the event of the battery becoming defective, the voltage of each element is tested to ascertain which one is useless, and it may then be replaced by a single new element. Naturally, the cost is considerably reduced. Another important improvement is the possibility of using the new battery in connection with almost any pocket lamp case now in use.

New Radio Station for China.—A receiving installation for the radio station at Royal Observatory, Hongkong, is now being constructed. The station is located at the observatory, in latitude 22° 18′ 13″ N., longitude 114° 10′ 15″ E., of Greenwich. The installation consists of a single triangular steel lattice mast 150 feet high. The aerial (which is on order in America) will spread from the mast to six chimney stacks of a terrace of houses 150 yards to the south of the mast. The receiving apparatus consists of a receiving set made by a British telegraph instrument manufacturer, and is to be used in conjunction with a Brown relay and high resistance telephone. At present the installation is to be used only for receiving time signals from Shanghai, Manila and Hanoi, and possibly from Tsingtau and one or more Japanese stations by night. After the war it is proposed to install apparatus for distributing time signals by relay via the Cape d' Aguilar radio station. The government hopes that arrangements may then be made for receiving meteorological observations from ships at stated times.

Interesting Audion Experiments.—Writing recently in the *Journal* of the Washington Academy of Sciences, L. W. Austin reports the results of interesting experiments made with the De Forest-Hudson filament audion at the U. S. Naval Radiotelegraphic Laboratory. The gas pressure used in audion detectors is generally below 0.001 mm. of mercury. By substituting nitrogen for air, to prevent the burning out of the filament, it has been found possible to construct detectors at all pressures up to that of the atmosphere. The action at 3 mm. is entirely normal. Local oscillations are easily produced, and the sensitiveness is fully as great, both for continuous and damped signals, as at the usual pressure. At 10 mm. the sensitiveness is about normal, but local oscillations are more difficult to produce. In the neighborhood of atmospheric pressure no local oscillations have been observed and the sensitiveness to spark signals is much less than at the low pressures. The conditions in this case would undoubtedly be much improved by bringing the electrodes closer together. Even with the ordinary arrangement of electrodes, the changes in the grid and plate currents due to the incoming waves are similar to those observed in the usual vacuum. With 200 volts, the plate current amounts to twenty or thirty microamperes. Data are also given on the effect of the direct-current voltage between the grid and filament on grid and plate signals.

Science

War Bread Recipes.—The Illinois College of Agriculture (Urbana, Ill.) has published, as Extension Circular No. 13, a pamphlet giving recipes for making various kinds of "war bread," most of which require no wheat flour. The list includes several varieties of corn bread, barley bread, rye bread, oatmeal bread, etc.

The Audion Receiver.—Some notable results achieved in radiotelegraphy with the audion receiver are reported by Mr. E. H. Armstrong in a recent paper on this form of apparatus. He states that at Columbia University with a single audion receiver signals from all high-power stations from Eilvese (Germany) to Honolulu are heard day and night. Cascade systems give correspondingly better results, two stages being sufficient to make the night signals of Honolulu audible throughout the operating room. The receivers in question have been developed in the Hartley Research Laboratory of Columbia University.

The Research Corporation, which was incorporated in the State of New York in 1912 for the purpose of developing the Cottrell electrical precipitation methods and undertaking general industrial research (not for profit), has, according to a statement in *Science*, grown to such an extent that whereas it started with a cash capital of $10,000 it is now spending that amount every month, and has a staff of 45 engineers and others in its employ. Besides the Cottrell patents, several others have been offered to the corporation, but none have yet been accepted. The corporation has established an industrial fellowship of the annual valve of $2,500, with the liberal provision that any discovery or invention made by the fellow shall be deemed his personal property.

Precise Leveling in the United States.—Although the Geological Survey, the Coast and Geodetic Survey and various other official and unofficial agencies are rapidly adding to the altitude data obtained by precise leveling in various parts of the country, the total amount of such leveling down to the end of 1916 was only 35,500 miles. In proportion to the size of the country this is considerably less than has been done in some of the European countries. It amounts to 1.2 miles of precise leveling per 100 square miles, as compared with 10.6 miles in the British Isles, 16 in Germany, 5.4 in Austria-Hungary, 3.5 in France, and 4.2 in Italy. In Japan there is an average of 5.2 miles of precise leveling per 100 square miles.

The Telephone in China.—According to the *Zeitschrift für Post und Telegraphie*, unofficial telephone services have not hitherto prospered in China for two reasons. First, although the Chinese are fond of using the telephone, it is found difficult to secure enough subscribers in any one place to support a local service. Second, the companies are exposed to the competition of the telegraph service, which is a government monopoly. Under these circumstances, it is likely that the government will eventually acquire the telephone lines that it does not already possess. Upon the beginning of the European war there was only one long telephone line in China; viz, from Peking to Tientsin. There were a dozen secondary lines, used solely in connection with the railways, and there were local services in Peking, Tientsin Shanghai and Canton.

Visible Sound Waves.—In *L'Astronomie* for July, 1917, are published three letters from different places near the war front describing the appearance in the sky of rapidly moving, parallel arcs of light and shade, seen at times when violent cannonading was in progress. In one case the moving bands were seen on a cloud by all the members of a battery of artillery. The description states that they moved with the speed of sound waves and their appearance coincided with the successive discharge of particular mortars. The space between the bands was greater for large than for small cannon. Apparently their visibility, which lasted altogether about ten minutes, depended upon particular relative positions of the observer, the cloud, the cannon and the sun. In another case, described by a French curé, the phenomenon took the form of slender bands sweeping over a blue sky interspersed with clouds. They were seen about halfway between the northern horizon and the zenith, and their shape was that of arcs of circles of very large radius. In this and the previous case the observers compared the circles to the concentric ripples produced by dropping a pebble in water. The air was calm. In the third description the observer compares the lines, moving across the sky, to the spokes of a gigantic wheel. Two of the writers correctly attribute the phenomena to sound waves; *i. e.*, alternate rarefactions and condensations in the air in the form of spheres of progressively increasing radius, of which the observer sees the projections in the form of circles. The optical phenomena involved in the production of such rings were discussed a few years ago by Mr. F. A. Perret in his description of the analogous "flashing arcs," seen in connection with volcanic eruptions. (Scientific American Supplement, Nov. 23, 1912, p. 324.)

Industrial Efficiency

"Da" Fibre in French West Africa.—The Journal Official of French West Africa states that at the request of the general government, an official study of the uses of "da" fibre, (Hibiscus cannabinus) grown in this African region, has been made. It appears that although this fibre is not suitable to replace jute in the manufacture of tissues, it is well adapted for rope making. The general government calls the attention of the colonial officials and merchants to the advantages offered by the cultivation of the "da," for there is a considerable future for this material.

Wolframite in Brazil.—According to an article in a Brazilian journal it appears that the best known deposits of tungsten in the shape of wolframite mineral are found on the Paraopeba river in the state of Minas Geraes, and also in the states of Bahia, Rio de Janeiro, Ceara, Rio Grande do Norte, and Parahyba. It is stated that a sample of metal sent to Rio Janeiro from Rio Grande do Norte, and taken from the Serra Branca region, was so pure as to exceed the Portuguese wolframite in quality. It appears however, that no analysis has yet been made to determine its industrial value.

Bonuses for Suggestions.—A leading camera manufacturer of this country conducts a contest of suggestions and ideas on the part of the employees, under the legend "Suggestion Department." Awards are made to employees for suggestions on improvement of product, reduction of costs, improvement in manufacturing methods, reduction of accident or fire hazard, and conveniences. The awards range from a few dollars to several hundred dollars, depending upon the value of the suggestion. Even the foremen of the departments having the greatest number of suggestions to their credit during a given period, participate in substantial monetary awards.

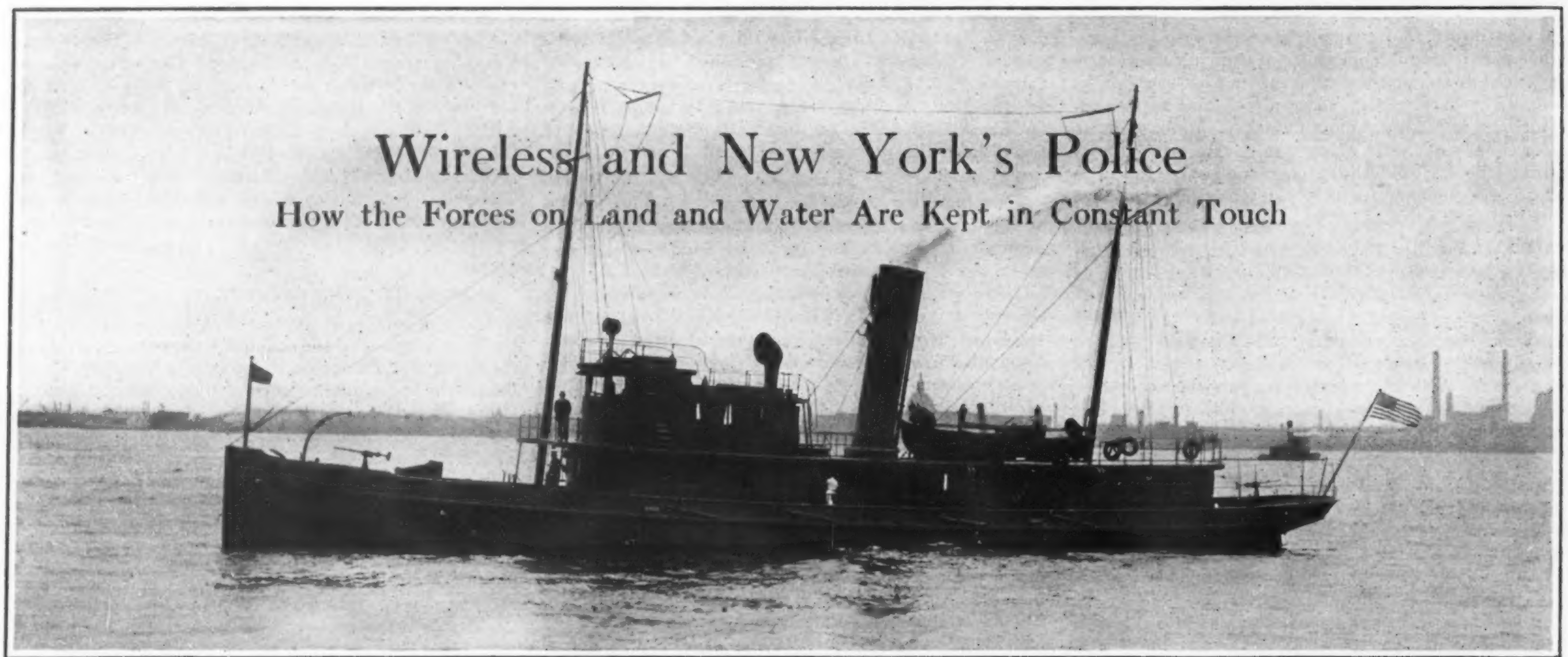
Fuel and Lighting Economy in Germany.—It is reported in the London *Times* that notice has been given by the General in Command of the Münster Army Corps District that the consumption of gas and electric power in shops, restaurants and other establishments must this winter not exceed one-half of the consumption in the winter of 1915-16. All the military and civil authorities, businesses, and other private undertakings are required to alter their office hours, from October 1st onwards, to the time between 8 A. M., and 4 P. M., Schools will keep the same hours. The lighting of shop windows and the use of passenger elevators are forbidden, and all restaurants are to be closed at 9 P. M.

Paper Pulp from Australian Lalang Grass.—A well known agricultural and technical chemist in Queensland has, says the *Indian Trade Journal*, conducted very successful experiments in manufacturing paper pulp out of *lalang* grass, or, as it is more commonly known, blady grass, on account of its very large blades which are four or five feet long. It resembles very closely the "esparto" of Spain and North Africa, and when dried before making it into pulp it yields as high as 60 per cent of first-class paper-making pulp. The expert states that esparto is the best pulp known, and the blady grass product is within 10 per cent of the same value. There are millions of tons of this grass growing in Queensland. Three crops a year can be cut from it, and this plant is said to be otherwise a curse to the country. He is also experimenting with other plants with good results namely Chinese "barr" (*Urena*) and the Queensland hemp (*Sida Retusa*). They produce 30 per cent of first class paper pulp. Lantana, which is also regarded as a great pest, makes an excellent wrapping paper. Screw pine, or pandanus, which also grows prolifically, is also the subject of experiments.

Efficiency and the Quartermasters.—Under the heading "Government Inefficiency," the *Traffic World* has the following to say: "Army quartermasters having charge of supplies are likely to be called on the carpet, if some of them do not take cognizance of the fact that the general order to all Americans is to make one car do the work of two. Some of them, according to reports, seem to think the order requires them to use two or three cars where one could be made to do the work. The most glaring example of wasteful use or inefficiency occurred in connection with the shipment of fifty carloads of blankets from the far West to an Eastern point and then their return to the West. So far as the men having charge of car service can ascertain, the only excuse for requiring that double haul is that it is in accordance with the routine of the army to have supplies counted at the Eastern depot. The shipment was handled practically on express schedule. It is also the practice of quartermasters to have supplies bought on the Pacific Coast sent to the depots at St. Louis, and Chicago, and then shipped back to troops needing such supplies. Quartermasters in charge of cantonments, however, have been accused, in an unofficial way, of the most henious offenses. In at least two cases, the cantonment quartermaster has ordered commissary supplies to be sent in refrigerator cars in 36,000-pound units instead of 66,000-pound units that can be loaded into such equipment."

Wireless and New York's Police

How the Forces on Land and Water Are Kept in Constant Touch



The steamer "Patrol" of the New York Police Department, which, being equipped with wireless apparatus, is never out of touch with the Headquarters station

AFTER a year of constant service, the wireless system of New York's Police Department may be studied in the light of what it has accomplished. Has it fulfilled its ends? Has it proved reliable? Is it worth while? These and other questions can now be answered.

It was during the summer of 1916 that the preparedness idea reached the officials of the metropolitan police. Something over 3,000 members of the force were trained in regular army camp life, under regular Army officials, and converted into a first-class military force capable of handling almost any emergency without the immediate aid of State Militia and Federal troops. And then the question of communications arose: What could be done to maintain communication between separate forces if the telegraph and telephone systems of the city should be disrupted by fire, flood, earthquake, cyclones, tidal waves, air raids, spies, strikers or other agencies? Someone suggested wireless. Whereupon wireless apparatus was installed at the Manhattan Headquarters, the Brooklyn Headquarters, and on board the Police boat "Patrol."

In its present state the station at the Manhattan Headquarters comprises a one-kilowatt quenched-gap transmitter, made up of a motor-generator set and control devices, a step-up transformer, a Marconi flat spiral tuning inductance and loading coil, quenched spark gap with blower, hot-wire ammeter, and, for short-wave work, a series condenser in the ground lead; and a Marconi receiver consisting of a loose-coupler, a variable condenser across the secondary, a potentiometer, a carborundum detector, and 3,000-ohm telephones. The receiving set has a wave length range of from 200 to 2,500 meters.

As for the aerial, the station makes use of a four-wire $\frac{7}{16}$ stranded phosphor-bronze structure, located on the north end of the Headquarters building. The length is about 90 feet, and the lead about 100 feet. At one end the aerial is supported by a wooden mast, while at the other it is attached to the tower in the center of the building, the height of the wires above the roof being about 30 feet. The aerial is of the inverted L type, and has a natural wave length of 350 meters.

Still more powerful is the Brooklyn Headquarters station, with its two-kilowatt synchronous-gap transmitter. The rotary spark gap is directly connected to the motor-generator set. The transmitter also includes a step-up transformer, a Marconi "squirrel-cage" oscillation transformer, a circular tuning inductance,

One-quarter kilowatt station on board the steamer "Patrol," which is in constant use to ensure communications with headquarters

and a short-wave condenser. The receiving set of this station consists of a Marconi tuner of the same type as that of the companion station.

The aerial is of the four-wire $\frac{7}{16}$ stranded phosphor-bronze type, located on the roof of the building. Its length is about 120 feet, with a lead of 59 feet. The wires are held about 50 feet above the roof between a mast and a water-tower frame. Of the flat-top T design, this aerial has a natural wave length of 260 meters.

A one-quarter kilowatt Marconi "cargo" transmitter is the voice with which the "Patrol" speaks to either Headquarters station. This transmitter comprises a one-half kilowatt motor-generator, with synchronous rotary gap discharger directly connected, a Marconi one-quarter kilowatt step-up transformer, a flat-spiral variometer type oscillation transformer, a loading coil and a short-wave condenser. A Marconi receiver is used.

The aerial consists of eight strands of $\frac{7}{16}$ stranded phosphor-bronze wire, swung between mastheads of the steamer. Its length is about 60 feet, and the lead about 40. The natural wave length of this inverted L type aerial is 198 meters.

The call letters of the Manhattan Headquarters station are 2ZA, those of the Brooklyn station 2ZO, and those of the "Patrol" KIN. The three stations are permanently adjusted to a 400-meter transmitting wave.

It is especially in wireless communication between Police Headquarters and the steamer "Patrol" that the value of the system has proved of greatest value in normal times. Previous to the installation of the wireless system, it was necessary for the boat to tie up at a dock and for an officer to find a telephone in order to communicate with Headquarters or the precinct. Naturally, this required much time, particularly at night. And when the boat was away from its pier, and navigating the New York waters anywhere between Sandy Hook and City Island or Spuyten Duyvil, communication was next to impossible. In other words, the "Patrol" might as well have been thousands of miles out at sea, so far as communication between Headquarters and the commander of the craft was concerned.

But wireless has changed these conditions. The "Patrol" is always within instant reach of either Headquarters station. Now when occurrences on the water, where police assistance is required, are reported by citizens over the telephone to Harbor A—the pier of the "Patrol"—or to Headquarters, the matter can be im-

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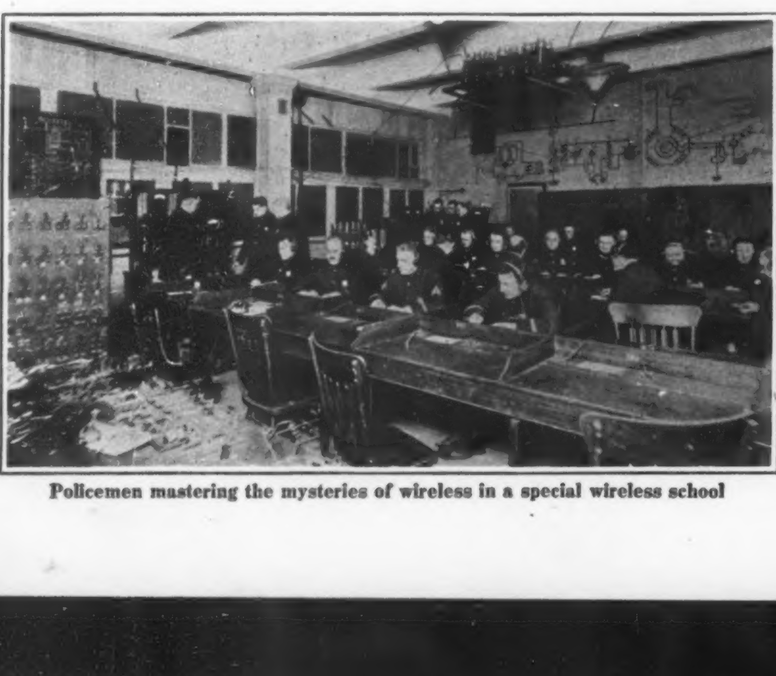
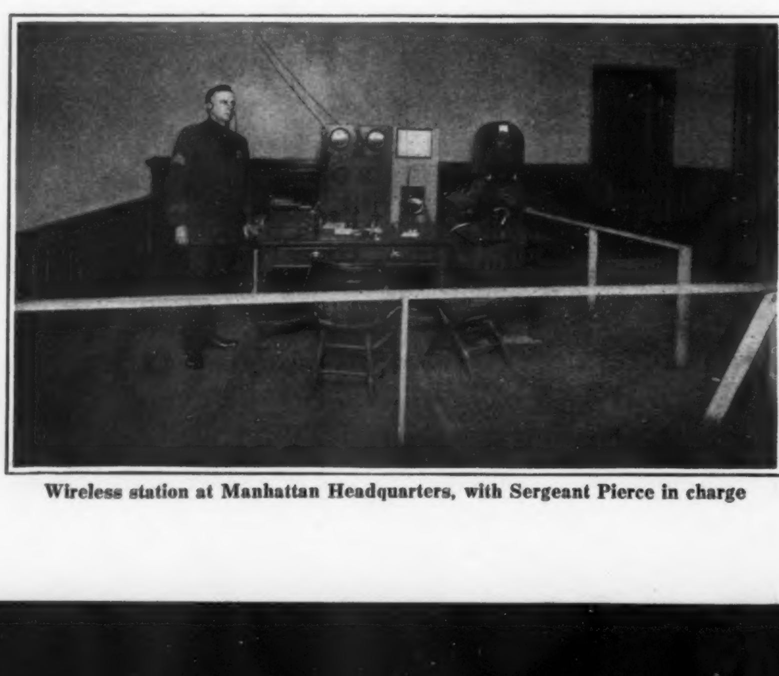


Policemen mastering the mysteries of wireless in a special wireless school



Wireless station at Manhattan Headquarters, with Sergeant Pierce in charge

The Submarine Problem—XIX.

Convoying as an Answer to the Submarine

JUST when the practise of convoying, or sending fleets of merchantships across the ocean under the protection of attendant warships, commenced we do not know, but we do know that in the long drawn-out wars of the latter part of the eighteenth and the earlier years of the nineteenth century, it was in full swing. That, of course, was in the days of the sailing ship, and the tactics of defense were simple. It was necessary, moreover, for the warships to keep the merchant fleet well in hand, and, as far as possible, in a compact formation, and the speed of the slowest ship, necessarily governed the speed of the whole convoy. From attack by solitary cruisers the convoy, except in case of fog or surprise, or of its being scattered by heavy weather, was fairly safe. Individual cruisers and privateers of the enemy feared to attack; and if the enemy showed up in force, the protecting warships moved out, placing themselves between the enemy and the merchantships.

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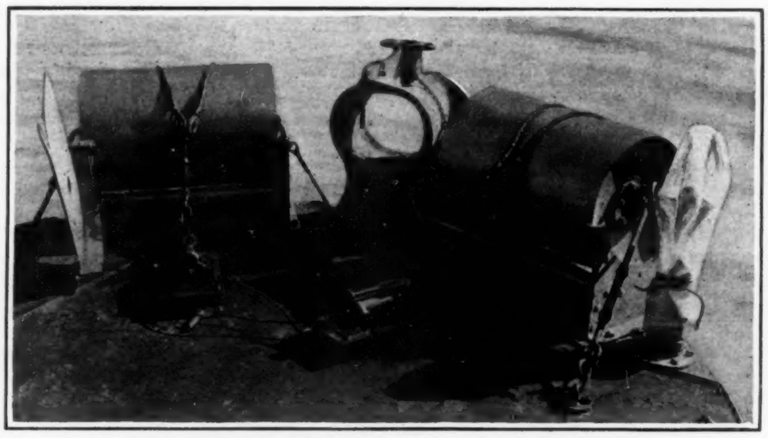
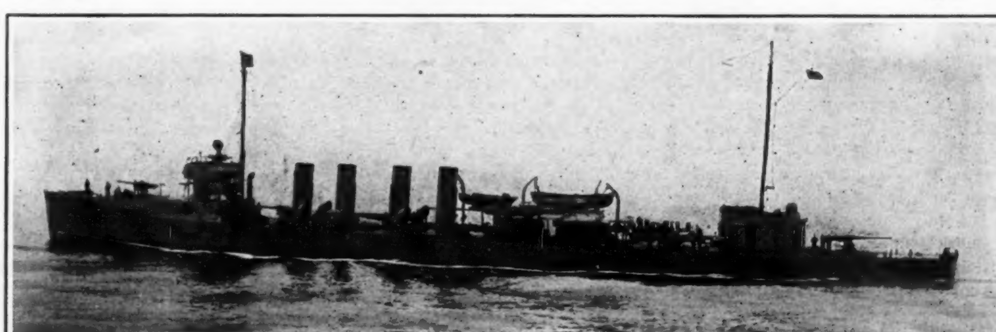
A fleet of British trawlers. These craft have no fear of the submarine. They are doing fine work in the danger zone

In the days of steam power, the whole system of tactics is, of course, radically changed. The elements of invisibility and secrecy have been introduced, and there is no such thing as a weather or a leeward position, unless indeed the possession by the warships and the armored merchantmen of superior gun power be considered to bestow upon the defense something of the advantage of the old weather gage.



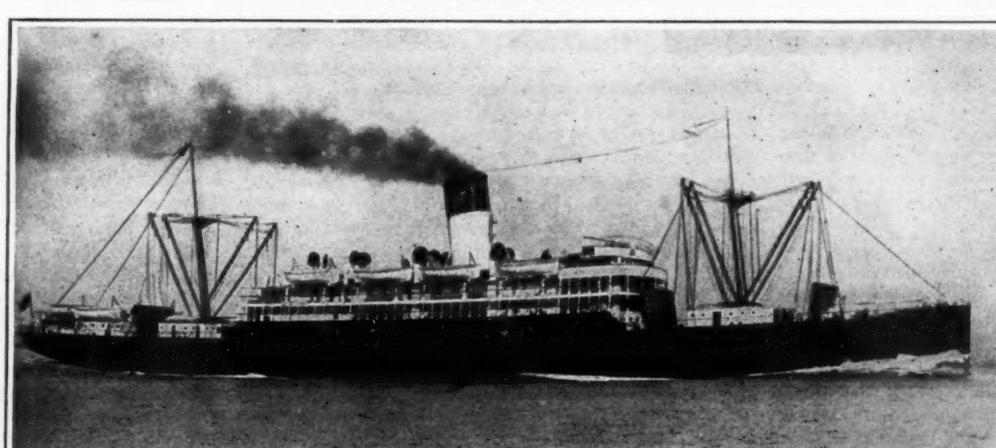
Setting the depth bomb at the stern of a U. S. Destroyer

When the history of the present submarine war comes to be written, it will be extremely interesting to note how the tactics, both of the offense and the defense, have changed to meet the ever-changing situation, and it will be difficult to award the palm for ingenuity, resourcefulness and adaptability to new conditions to one side or the other. In the first year or so, the defense placed its reliance upon nets and the covering of the submarine-infested waters with a swarm of patrol craft, big and little. The submarine countered against these by the use of net cutters, which apparently have now reached a stage of efficiency that enables them to pass through the heaviest nets that have been laid. The submarines, moreover, have grown in size and sea-keeping ability, so that now they are operating several hundred miles to the westward of the European coast line.



The destroyer—A type which has proved the master of the submarine. We have over two hundred under contract

As we pointed out several months ago, by merely extending the cruising radius of her U-boats, Germany has placed all the mathematics of the problem against the Allies and in favor of herself—at least so far as keeping the surface of the submarine zone everwhere under adequate patrol is concerned—for if the distance from the coast of a submarine's operations were doubled, the number of patrol ships necessary to maintain a given density of patrol, so to speak, would have to be quadrupled.



The Army transport "Antilles" of 6878 tons, sunk on a return trip to the United States without troops

Now, this situation could be met in one of two ways: the first, and obviously the most desirable, was to blockade the submarines at the exit from their bases, or at least so confine them that they could not get out on the Atlantic routes. The obvious way to do this would be with the net; but the British, who have been most severely hit by the submarine piracy, and have therefore the most at stake, have come to the conclusion that netting on any extensive scale is impracticable. We understand that they tried out the net method during the first two years of the war in many different localities; but the inability to hold them in place where the tide runs fast and seaweed loads down the net, has led them to the conclusion that other methods of meeting the submarine can be found that are more efficient. Moreover, the Allies deem it inexpedient to raise the question of violating neutrality which would be involved in carrying the nets into neutral waters—something which is absolutely necessary, at least in many locations, if the net is to prove effective.

There remains the method of convoy in great strength; and this has the advantage that it forces the submarine, in order to reach its prey, a merchantship, to come into the radius of action of the escorting men-of-war; and these, as we know, are fitted with weapons—the gun and the depth bomb of which the submarine stands most wholesomely in fear. The modern method of convoying, which is not affected by the wind, as was the case in the days of sail power, is to surround the transports and merchantships with a ring of defense of swift and heavily-armed warships, principally of the destroyer type. The distance of the ships from the convoy is such that, if the submarine sighted and fired its torpedo at a safe distance outside the line of warships, it would be too far away to have much chance at scoring a hit; and if it passed under the warships and came up between them and the convoy it would probably be forced under by a storm of concentrated shell fire before it could aline itself for an aimed shot.

There is, of course, an element of luck which may defeat the most carefully thought out and executed tactics of the defense. A submarine or two may find itself in the course and dead ahead of an approaching convoy, and by submerging and using its listeners, conceivably it might come up among the transports or merchant ships and get home a successful shot. This possibly is what happened in the case of the "Antilles." However, such a thing can happen only under exceptional and necessarily very rare conditions, and such instances will diminish as the anti-submarine destroyer fleets of the Allies increase in numbers. Great Britain is putting through a very large destroyer program, and the United States is doing the same. Germany cannot hope to put afloat U-boats at the rate the combined Allied Navies can build destroyers and trawlers; and hence the defense will become increasingly effective as the weeks go by.

A New Wood, the Lightest Known

A NEW wood, apparently little known and called balsa wood, is exceedingly light and promises to have an extended field of usefulness in connection with cold storage structures when heat insulation is important. It is a tropical wood growing principally in the states of South and Central America.

The wood is remarkable, first, as to its lightness; second, as to its microscopical structure; third, for its absence of woody fiber; fourth, for its elasticity; and fifth, for its heat-insulating qualities. So far as the investigation has disclosed, it is the lightest commercially useful wood known. It has also considerable structural strength, which makes it suitable for many uses. In general appearance balsa wood resembles basswood. Until recently, Missouri cork wood, weighing 18.1 pounds per cubic foot, was believed to be the lightest, but recent investigations indicate that balsa wood is much lighter, having a net weight of 7.3 pounds per cubic foot. The ordinary commercial balsa wood is seldom perfectly dry, and, because of the moisture content, its weight has been found to be between eight and thirteen pounds per cubic foot.

The extreme lightness of this wood suggests its application as a buoyancy material in life-preservers and life-boats. When, however, it was attempted to apply the wood practically, it was found to be of little value, because it absorbed water in great quantities and also because it soon rotted and also warped and checked when worked. After testing nearly every method that had been suggested, Colonel Marr's method of treating woods which had been recently patented was finally successful. In this method the wood is treated in a bath, of which the principal ingredient is paraffin, by a process which coats the interior cells without clogging up the porous system. The paraffin remains as a coating or varnish over the interior cell walls, preventing the absorption of moisture and the ill-effects as to change of volume and decay which would otherwise take place; it also prevents the bad effects of dry rot which follow the application of any surface treatment for preserving wood of the same type. The Marr process tends to drive out all water and make the wood water-proof.

After the War—What?

I. Economic Results That Will Follow the Conclusion of Peace

By Ludwig W. Schmidt

THE page of history shows that all great wars have been followed by a period of great economic activity. The duration of this period is dependent upon the condition in which the world and the warring nations are left at the coming of peace. Thus Germany after receiving the French indemnity in the early seventies, went into a riot of prosperity. Money was plenty and easy to get, and was spent as fast as made. The unavoidable smash came early enough. It is generally asserted that the withdrawal from the markets of the huge sum laid away by the government in the Spandau tower was the cause of the great depression which followed. It is, however, much fairer and nearer the truth to regard this action as merely having given the last blow to a generally unsound structure.

The period of reorganization was not less pronounced in Japan after the war with Russia. Our own exports to the Mikado's kingdom show a rapid increase from $24,000,000 in 1904 to $51,000,000 in 1905, with high figures for the next three years also. But after 1908 the stimulating effect of the war upon Japan's imports had spent its force, and for 1909 and 1910 our Japanese trade returned to normal figures of $26,000,000 and $21,000,000.

The smash in Germany came in the middle of the seventies; in Japan the period of high economic activity following the war measured three years; after our own Civil War it was about the same length. There is every reason to believe that it will last approximately as long after the present war. It takes about six months to get the armies disbanded and the decks cleared for action generally. Only then it is possible to estimate the full extent of the losses and to put under way the steps necessary for restoring to working order the countries affected.

After the war which we are now fighting the world will approach the reorganization phase in a different mood from that which has been seen in the train of any previous conflict. This is not a war affecting the economic life of two or possibly three nations, with the rest looking on, getting rich on the wartime needs of the belligerents, expecting greater riches to accrue from their aid in post-bellum restoration. All the powerful nations of the world have been drawn into this vortex; even those which have been able to remain neutral have been vitally touched. When peace comes everybody will be in the same boat; no nation will have escaped the drain, none will be in a position to help much the exhausted combatants regain their economic balance. Certainly none of the belligerents will be able to send great quantity of materials abroad—everything they can produce will be needed right at home. Nor can help be looked for from the neutrals, who have suffered economically almost as much as the nations actually at war. When peace comes everybody will be in the market to buy new supplies, rather than to sell; and where will the demand be met?

With Germany and her allies depleted of all the important raw materials formerly imported, with Russia at the point of exhaustion, with England and France living on rations, with the United States, hitherto a treasure house of raw materials, themselves under the care of a food controller and a host of committees to prevent waste of resources—with all this as it is, can it be surprising that even now, with peace only a dim prospect of the distant future, the question is raised of what will happen when it becomes an accomplished fact? When all the nations, underfed for three years, empty of raw materials, bare of machinery, are enabled to enter a free market, what will be the result? Will peace be a blessing, or a calamity? Will prices rise to the unattainable under the pressure of tremendous competitive buying? Finally, and principally, will there be enough of all the world's goods to go around among the frantic buyers?

That there will come a period of heavy buying after the war cannot be doubted. Not only is this expectation supported by past experience, but anyone with an eye to see can see it for himself. Unfortunately it seems just as certain that there will a notable deficit in available stocks and possible production. Solution of the problem seems hopeless unless the world is willing to take the one step of a general apportionment of existing stocks of materials and foods. This alone can save the situation; and this, too, opens the way for a better coöperation among the leading nations in the future than has been realized in the past.

If order can but be created in the present chaos there is no real cause for panic. It is generally admitted that in years before the war the world has been consuming raw materials far more lavishly than absolutely necessary. Waste is not peculiar to war; by eliminating the waste of peace, we may be able to cure that of war. There is indeed hope that by making saving a virtue of peace, and carrying it into every possible corner, we may find sufficient food and materials for all. This hope is bolstered by the fact that the war reduces consumption as well as production. During the actual continuance of the war, with all the men under arms removed from production but not from consumption—with these men, in fact, consuming at a rate vastly in excess of normal—this is of course not the case. But when we go back upon a peace footing, the loss of 7,000,000 killed and 9,000,000 not born must of necessity reduce the world's consumption of all things by just so much.

Assuming that the world is willing to take the great step and put itself under the direction of a committee of apportionment, there will be work for an organizing genius of the first water. It will of course be necessary to throw the main burden of support on each nation for itself. Each will have to provide for its citizens that amount of food and raw materials which can be produced inside its boundaries. Of those things which each nation can produce in surplus, each will give to those with a deficit. England, Germany, possibly France, have increased their output of foodstuffs and will therefore possibly need less from abroad than in previous years. Of cotton the United States will continue to show an enormous surplus over domestic wants, and all indications are that here the production will cover the total demand. Copper on the other hand will be more in demand and less to be had. Iron is found in all the major countries, and it is possible that one of these will be able to dispose of it in quantities that will count.

A part of this scheme essential to its success would be the curtailment of domestic over-consumption. It is, abstractly, much better that the United States go on an 80 per cent allowance in some commodity in order that France be supplied with 60 per cent of her accustomed consumption, than that we have our usual supply and France but a quarter of hers. If the laws of supply and demand are given free rein, and no effort made to control competitive buying, something approaching the former alternative would be brought about anyway; why not effect the same result by a more rational process? In this way some degree of satisfaction might be given all.

Unfortunately, there is little hope that the world will take this desirable course. There are even indications that the struggle will be prolonged in the form of an economic war. But whatever happens, nothing will prevent men from reestablishing themselves on the ruins and rebuilding what has been destroyed. The empty stores must and will be filled, the ravages of war must and will be repaired, so as to make possible any sort of business. All this may have to be done under far greater difficulties than would be the case if an understanding could be reached; but this will affect merely the time and labor necessary to bring about the result, and not at all that result itself. There will be, at least in the beginning, fewer ships to carry the products of the world. Freight rates, high today, will continue high under the pressure of demand and of high operating expenses; and high wages all over the world will do their share toward increasing the cost of production.

The impetus gained by this activity will carry the world for a series of years. But one day its limit will be reached. All the fields necessary for providing the needed food and agricultural materials for the coming season will have been tilled; the mines will be in operation again, and will have caught up with consumption; the houses required to give the race habitation will have been built; the shipyards will have provided all the necessary ships for ocean traffic. Labor will have accustomed itself to the new conditions, capital will have come to acept them; and then one morning the world will awake to the fact that all has been done that was necessary to make it again habitable. The end of the period of after-war prosperity will have come.

The real, far-reaching results of the war will only then begin to show. The loss of productive power, of money, of national efficiency, will then for the first time become evident in all their nakedness, and the affected countries will be forced to establish a new standard of national prosperity which must be considerably lower than that prevalent before the war. It is this period which it is most difficult to bring to an end.

After the Franco-Prussian wars and the Russo-Japan conflict, the characteristics of this secondary period of depression were various. First was a shortage of money. Available funds had been spent in rebuilding and in the purchase of new equipment. Also, of course, by those who had lost money there was much hoarding with an eye to future necessities. The visible result was a curtailment in the spending of money which in turn affected the general situation of the market. The building activity which had given work to many decreased until it came to a total stop. In Germany the period of depression was preceded by a building smash of unusual heaviness. Curtailment of industrial production brought in its wake unemployment and wage reduction. Prices for foodstuffs and materials showed the results of inflation by holding up for a while, even in the face of the lessened takings of the wage earners. Finally a general depression set in, forcing down the prices for all commodities and service. The finishing touches then came with embarrassment to all concerns which were operating on a capitalization inherited from the flush years immediately after the war, and which were accordingly unable to meet their overhead when the general scale of values had been pared down.

All this must be expected after the present war. It will affect agriculture, industry, commerce, transportation. The latter field is an especially exposed one in this respect; railroads and steamship lines must continue operations, in the face of all expense. Moreover, just now many new railroads are built, regardless of cost; and the United States Shipping Board announces that within a year we shall put in the water a thousand ships, of 9,000,000 tons, built at a time when all essential materials are at a level three or four times as high as that which prevailed before the war and which may be expected afterwards. England and Germany are also building ships. Will the earnings of our new railroads after the war be sufficient to meet capital charges? Will the earnings of all these new ships always be large enough to recompense their owners for the prices they are paying for them? The answer can hardly be other than "No."

The outlook is not a pleasant one; but there is one consolation. What is taking place through this period is nothing less than a revision of the values created by the war and the period immediately following it. All these are on a false basis, and revaluation is in order. This completed, by painful process of receiverships and national hardship, the way is open for a new period of national prosperity. The Civil War led straight to the economic development which made the United States a power in the world's affairs. Germany dates her enviable industrial position from the Franco-Prussian war, and Japan has entered the ranks of world powers since her conflict with Russia, while the latter country's development of the past decade can be traced to the same cause. So when once the scale of normal values is re-established after the present holocaust, we may expect the world to move forward with a notable acceleration.

Artificial Wood from Autumn Leaves

SAWDUST and "wood flour" have long been used for the making of artificial wood, and now an ingenious inventor has applied for a patent on a new process by which dry leaves are employed for the same purpose, the great advantage, of course, being the greater cheapness of the raw material. Any sort of leaves can be used, but oak, birch and beech are particularly good. As described in *Neueste Erfindungen und Erfeheungun* (Vienna) the process is as follows:

It is preferable to begin by having the leaves ground up. They are then mixed with a suitable binder; for this purpose glue (four ounces), rosin, water glass, casein, etc., can be employed, but viscose is the best, and it is possible to make the viscose from a portion of the leaves used. For certain purposes, moreover, it is possible to make use of "fillers" to mix in with the mass, such as asbestos, infusional earth, wood flour, peat flour, etc.

The finely ground dry leaves are boiled in soda lye and are then without delay mixed intimately with an already prepared solution of viscose. The resultant mass is placed in suitable press (presz formen) moulds and subjected to a pressure of 350 atmospheres.

The shapes obtained are dried and then subjected to a warm "after pressure." The viscose can be made from the "leaf meal" by treating the latter first with soda lye and then with carbon disulphide fumes.

To increase the binding power of the viscose, in consideration of the jelly-like cellulose separated out from it small quantities of other binders, such as glue, water-glass, casein, waste sulphite liquor, etc., can be added. Color can be added either to the mass or to the leaf meal.

New Vegetable Wax from Ecuador

FROM prehistoric times the Indians of Ecuador have utilized a wax found on certain species of tall palms for making candles. This wax occurs on the tree trunks in granular form, each tree furnishing about fifty pounds. The trees grow in great numbers on the mountains along the coast. Samples of this wax were sent to France and Germany from which countries favorable reports and an offer of 19.5 cents a pound were received, but the war terminated further negotiations.

Inventors Whom I Have Known

Personal Reminiscences From Both Sides of the Atlantic

By Wallis Nash

SOME of the most interesting men whom I have known well in a long life, passed about half in England and the last half in a Pacific coast state of America, have been inventors, who, it may be said, have many traits in common in both hemispheres.

The first, with whom I lived in many years' friendship in England was Fred Ransome, the father of artificial stone. He came from Ipswich, a large and busy town in Suffolk; he was a chemical and mechanical engineer. He had conceived the great idea that by a combination of carbonate of lime and chlorid of calcium the soluble elements could be washed away, and an artificial stone, combining density, hardness and durability would result. He would tell me that his invention was comparable in its qualities with the centuries-old Roman cement. He got many friends interested, among them Sir Henry Bessemer, the steel man, and a factory was built on the banks of the Thames at Greenwich.

Both the factory and the inventor lasted a good many years, though he never made a fortune. The truth was that although his laboratory experiments were most successful, when they came to be translated into the factory there was too often a slip in the final processes, which proved fatal when rain and frost got in their work. He was more successful when he adapted his invention to outside washes on buildings. He was a true inventor, never admitting failure or giving up the battle.

Sir Henry Bessemer, whom I mentioned, was the Chairman of the Ransome board, with whom I sat regularly and pleasantly for a good many years. In appearance he was most striking, both in frame and feature—massive and solid in build, with a lofty forehead and large, deep, dark eyes. In speech he was very gentle, and a warm friend to those he loved. Having thought out the "Bessemer process" he never ceased striving for complete success.

He began at a small factory and foundry in the City Road—a North East district of London—there he invested every cent of his own and his friends' money that he could control. He told me once that in the last heat of the furnace, which finally yielded the steel—even his wife's wedding ring was in the melting. He was an inveterate inventor. Over two hundred patents bore his name. Many of them were more or less successful, but the steel-making yielded him what was a large fortune in those days.

Next in the diary of my memory come the two brothers Prentice—James and Eustace. With them was associated the then Chief Chemist of the British War Department. To those men the development of guncotton, both in war and mining, is due. The chief factory was placed near the town of Stowmarket, in Suffolk—too near, as events proved. Eustace Prentice traveled over England, introducing the new explosive. He was always to be seen with a neat, small suitcase, which I regarded, when I bore him company, with much suspicion. He treated it always with great care, placing it on the cushions of the railway coach.

The first thing disclosed when he unlocked it was a neatly-folded roll of the finest white muslin—then some shot-gun cartridge cases, and a few of larger size. In those early days of guncotton the bit of rapidly-explosive white muslin was intended to envelop the mass of the explosive cotton and so explode the entire charge at the same instant. That was only one of many devices to regulate the rate of explosion. Between that day and this there have been countless changes and many improvements.

I remember when on one occasion Eustace Prentice and I were staying the night at a mining man's house in the North of England. We were chatting with the hostess in her sitting room. The door was flung open and the nurse girl rushed in with a face the color of ashes. "Oh ma'am," she cried, "I'll never take anything again that isn't mine!" "What's the matter, Mary?" said the mistress. "Oh!" she cried, "I was just straightening the gentleman's things in his bedroom when I happened to see a whole roll of clear white muslin, and I thought just a strip would never be missed, so I took my scissors and cut off a strip: then, Ma'am it felt damp, so I took it into the nursery where there's a fire, and set the muslin in front of the fire: I turned my back for an instant when there was a puff, and the muslin was gone—not a bit of it left, and I thought it was because I'd taken what wasn't mine. Oh please, Sir, forgive me!"

Another time we were in the tin mines of Cornwall, and Prentice had been down among the miners, showing off the guncotton cartridges. All were delighted, superintendent, foremen and miners. There were a couple of cartridges over, and the foreman asked the visitor to leave them with him that he might try a blast for himself. Leave was given, but careful warnings were added. The demonstrations were to be continued the next morning. The first thing Prentice saw when he got out of the cage was a group of the miners surrounding the foreman, whose hand was being bandaged up. Mr. Prentice asked what had happened. The man answered very shamefacedly: "Why, sir, I'd got a pretty good hole drilled, but when I set in the cartridge either the hole wasn't deep enough by an inch or the cartridge was an inch too long, so I got the cartridge out and set to to cut an inch off it with my pocket knife: I was sawing away on the edge of the hole when I suppose I must have struck a spark on the rock, and off she went, cartridge and knife and all and came near taking my hand off with it!" Prentice's face blanched, as he blessed God that the rash miner was alive to tell the tale. Doubtless he owed his life to the cartridge being unconfined.

It was not long until guncotton became a recognized part of the equipment of the Royal Engineers—though it was several years before its submarine qualities were worked out.

All the inventors whose life work I have so far sketched have passed from this life. But the most noteworthy survives, to bear well the burden of his honors, the world over. Early in 1879 I was invited to the office in the City of London of the solicitors to the General Post Office—good friends of ours. The senior partner explained that their hands were over full of important business, and that they would like to turn over to our firm an American client, recently arrived, the inventor of a new system of communication by wire, that augured

(*Concluded on page 353*)

Correspondence

[*The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.*]

Readers for Fifty Years

To the Editor of the SCIENTIFIC AMERICAN:

Have just seen the claim of Mr. C. B. T. Hutchins that he "the said C. B. T. H." was the oldest subscriber. That claim is challenged. The writer after three years of picnicking through the South with Uncle Billy Sherman went to Neenah, Wis., in November, 1864. In 1865 began buying the SCIENTIFIC AMERICAN from a news stand and in 1866 subscribed to it and still am at it. As the writer was born in 1841, I have the age on Mr. Hutchins there and think I have priority as to SCIENTIFIC AMERICAN. I have also taken every number of the SUPPLEMENT from 1876.

A. GALPIN.

Appleton, Wis.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of October 15th, Mr. Hutchins claims to be your oldest subscriber. I want to enter my claim for that honor. I was born in Ohio, March 22d, 1832, was married in 1854 and began taking the SCIENTIFIC AMERICAN in early summer of 1856 and have taken it continuously ever since, except two years during the Civil War. The numbers are carefully filed and the volumes preserved. When I left Ohio to come to Florida in 1884, the volumes were then given to the town library; in 1910 I gave 38 volumes (19 years) to one of our State Colleges.

During all this time it has been the highest authority with me, on all subjects that it editorially treats of. Does 59 years and six months take the chromo?

My strength is nearly gone, a walk down town everyday is about the limit. Have been blind in left eye for over six years, right eye, looking through a pin hole, very hazy (glaucoma). The typewriter is a great help, or you would not get this letter.

A. L. BROWN.

Eustis, Fla.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of October 13th, 1917, C. B. T. Hutchins says he thinks he has been a subscriber for the SCIENTIFIC AMERICAN longer than any one else.

I am not able to give the precise date when I became a subscriber, but it was in the early fifties. I feel quite sure it was in 1853, and if so I have been a constant reader for 64 years. I also have had the SUPPLEMENT from its start in 1876. My name has not always appeared on your subscription list, although I have been a constant reader of both papers. Mr. L. A. Kern and I have been taking the two papers for several years, both sent to his address.

The 13th of this October was my 87th birthday. Am still active, never used a cane, never needed one.

Montgomery City, Mo. C. P. EVERED.

To the Editor of the SCIENTIFIC AMERICAN:

. . . I was born in 1840. When I was eight years old I was in the chicken business and at the same time experimenting with windmills. Well, the good miller near our home, Mogadore, Summit County, Ohio, gave me the sweepings of the mill, if I would sweep it out carefully. In doing this one day I saw a copy of the SCIENTIFIC AMERICAN on his table. It took my attention at once and when he saw I was so much interested, he loaned it to me and finally gave me some back numbers and I was so much more interested he finally gave me a big book containing every number. It had then been published about three years. From that time to this I have kept track more or less of what's going on in the scientific and mechanical world through the SCIENTIFIC AMERICAN. . . .

A. I. ROOT.

Medina, Ohio.

To the Editor of the SCIENTIFIC AMERICAN:

In response to the query of your recent correspondent as to the oldest subscriber to the SCIENTIFIC AMERICAN, will say that my father was the recipient, either by purchase or subscription, of the first number of that publication and continued its use down to the time of his death in 1861. At that time the writer became a patron, either by purchase or subscription and has continued so, down to the present day. I now have in my possession bound volumes of the paper, in perfect condition, from 1848 to 1859 inclusive. While I am perhaps not technically the oldest subscriber, I can claim to be one of the oldest patrons.

W. G. STONE.

Utica, N. Y.

The Pulley Puzzle

To the Editor of the SCIENTIFIC AMERICAN:

The solution of the "Pulley Puzzle" on page 291 of your issue of October 20th, contradicts itself in two consecutive sentences. It states that "when he pulled up with a force of 300 pounds his feet pressed down with an equal force on the stone, *making a total load of 600 pounds*." The next sentence states that "the supported chain held 300 pounds." Now the moment the block of stone left the ground, this chain attached to the beam became its *only* real support, hence the total load could not have exceeded 300 pounds.

Though the man's feet pressed down on the stone with a force of 300 pounds nothing was thereby added to the weight to be raised, any more than it would have been had the stone been a plank of the same weight, so balanced as to permit him to lie on his back and pull horizontally, with his feet braced against the frame of the pulley. A force of 300 pounds exerted in this way would have produced the same result. (In this, as well as the published calculations, the weight of the pulley and the force necessary to overcome its friction are neglected.)

As a matter of fact, the principle of the loose pulley is not applied here. The man and stone rise at exactly the same rate as he overhauls the chain, hence he gains no leverage or mechanical advantage, nor is the weight divided between two supports. This is further proved by the fact that the spring balance registered his pull at 300 pounds—the total weight. Except that he lifts with the muscles of his back rather than with those of his arms, he is no better off than he would be if the pulley were discarded, the stone attached to his feet, and he grasped the chain overhead and pulled. If he were able to exert a force of 300 pounds in the latter position, he would rise and take the stone with him.

The mathematics used to explain the experiment is equally faulty. As a premise it is stated that the force F with which the man pulls up on the chain $= \frac{1}{2}(M + S) = 150$ pounds—whereas the spring balance showed that $F = 300$ pounds. It takes a whole geometric progression to overcome this initial error and restore F to its real value!

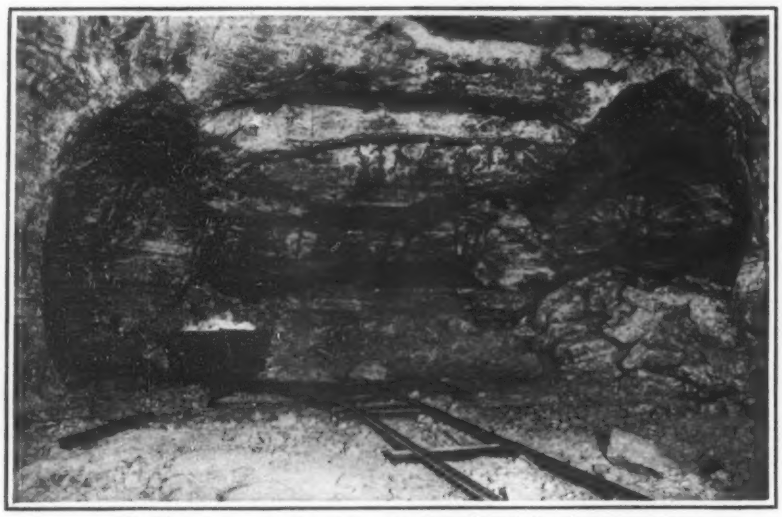
It appears that the presence of the inoffensive pulley acted on the mind of the experimenter as a perfect camouflage for what actually happened—simply that a 190-pound man, with a straight pull, lifted 300 pounds by exerting a force of 300 pounds. There seems nothing extraordinary about this except the disguising paraphernalia employed. I have seen a 160-pound man sit on a platform scale on wheels, grasp the framework underneath, and with a powerful pull force the beam to register 700 pounds. Possibly the teacher of physics in the Kansas State Normal at Emporia could produce a geometric progression "smoke screen" to obscure this equally simple operation.

EVERSLEY FAY.

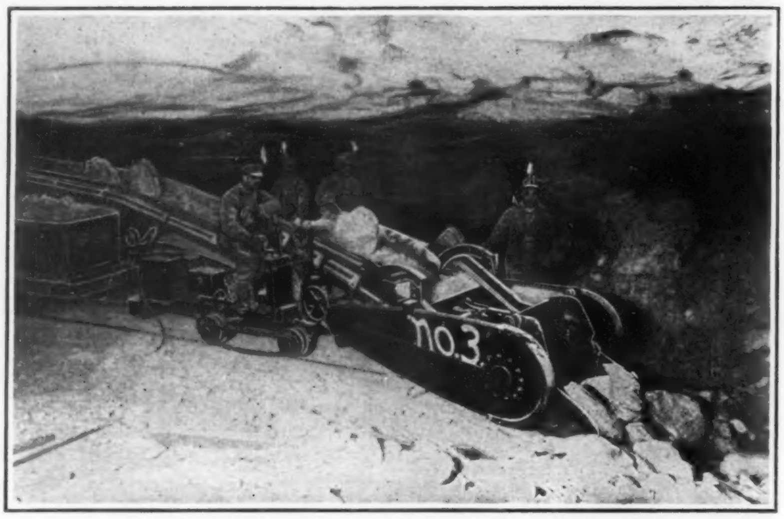
Mining Rock Salt

How Operations Are Conducted in the Crystal Caverns

By Ernest Elva Weir



Working face of salt mine, showing drill holes in the rock



Electric shoveling machine used after the blast

ROCK salt is the term applied to all salt taken from the earth by the usual methods of mining with pick, shovel and dynamite. It occurs in nature in veins or large masses in many parts of the world. The veins vary from 10 to 1,000 feet in thickness, the largest ones, however, being usually divided into 12- to 18-foot sections by thin layers of shale.

Mining is carried on by the chamber and pillar method of excavating, so much salt being available that pillars are left to support the roof instead of putting in the expensive timber work customary in mines producing more valuable minerals. The air in a salt mine is very dry and the high chamber roofs greatly simplify the question of ventilation. The mines, too, have enjoyed remarkable freedom from accidents due to the absence of noxious vapors or explosive gases. Flues are provided to carry off the powder gases from blasting.

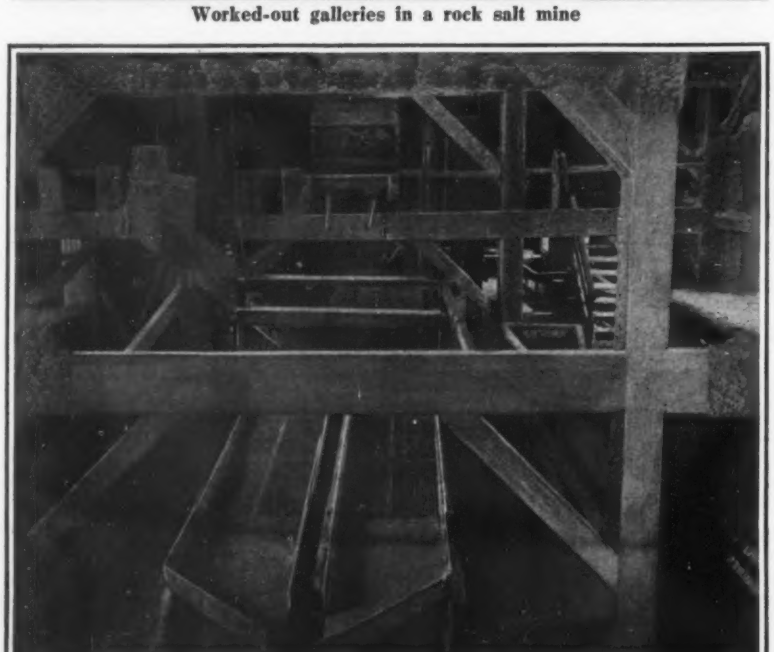
In sinking the shaft, which is about 20 by 8 feet and is put down by digging and blasting, quicksand and underground water encountered in the first hundred feet frequently give the operators considerable trouble. It is necessary to use heavy concrete curbs to keep the workings dry and in extreme cases, either concrete is forced all through the sand surrounding the shaft or the quicksand is frozen by refrigerating pipes. Between bedrock and a working vein, which may be anywhere from 250 to 1,100 feet or even more below the surface, the work usually progresses without incident. When the shaft reaches the vein, a fairly large room is excavated and a pit or sump dug to catch any water that may find its way down the shaft. The pumps are then installed and the head-house equipped. A large tipple is built over the pit and the hoisting apparatus, screens, crushers and bins put in place.

The shaft is usually provided with two cages working in separate compartments, the arrangement being that when one cage comes up, the other goes down. Between the two hoist ways is a shaft for safety ladders, the discharge pipes from the pumps, electric cables for light, power and signaling, and also for the hose carrying the compressed air for the drilling machines. Powerful fans draw air out through this central shaft until the workings become so extensive that it becomes necessary to dig additional shafts or drill large holes at other points to ensure adequate ventilation. After laying tracks around the tipple for the rapid and economical loading of cars, the mine is ready for operation.

To gain as much working space as possible, galleries or tunnels are driven in all directions from the bottom of the shaft, their width varying from 30 to 75 feet. The excavation is carried forward by boring holes in the salt to a depth of about seven feet; this is done with drills operated by compressed air or electricity. The first holes are drilled near the floor line, charged with a low explosive and the salt blown out. This work is sometimes done by a special undercutting machine. The first cutting is driven back as far as circumstances require, then further drill holes are placed in the face of the salt above this undercut, charged, and the salt blown into the open space beneath. This work of blowing down the roof continues until a height equivalent to the depth of the vein is obtained, or, where the vein is very thick, until the chamber is as high as safety permits. Chambers are mined to a height of 70 to 80 feet. They are very beautiful, particularly in the higher workings, where the sparkling, crystal white salt reflects the light and the high arched ceilings give the effect of a huge cloister.

Cross galleries are started when the main galleries have reached a predetermined length. These are of the same width and height as the main arteries of the mine, and the distance from center to center of the cross galleries is twice the width. Hence, the plan of a salt mine somewhat resembles a checker board, all the white spaces and half the black being cleared of salt while the remaining black are left untouched to hold up the roof. The upper part of the chambers are arched and all loose pieces of salt removed to avoid accidents.

Worked-out galleries in a rock salt mine



The shaking screen that grades the salt according to size

The blasting breaks the salt up into pieces of all sizes from fine dust to huge lumps weighing tons. When the latter have been reduced by sledges or small charges of explosive to a removable size, the salt is shoveled into small cars and pushed to the hoisting cages on tracks. Electric shovelers, sometimes used to save time and labor, are powerful machines with a motion very similar to a man handling a shovel except that the reach is about seven feet on either side or in front of the track on which they run.

When the salt reaches the shaft foot, it is dumped from the mine cars into large buckets attached to the hoisting cages, the buckets dumping automatically at the top of the tipple. The salt then passes over a grating of large iron bars known as riddle-bars. This separates the larger lumps which are taken by conveyors to the ground floor to be piled for seasoning and final shipment as lump rock salt. Until aged, careful handling and storage is necessary, the salt being very brittle when first taken out of the mine and toughening only through exposure to the air. The remainder of the salt goes through crushing rolls, then passes over shaking screens which separate the different sizes of crystals, and finally finds its way to the large storage bins in the lower part of the tipple. Automatic weighing machines fed from these bins weigh the salt out into the various sized sacks, which are then sewed and trucked to the cars.

Probably the most famous salt mines in the world are at Wieliczka in Galicia, whose worked-out rooms are the mecca for thousands of tourists each month in times of peace. In this mine, there is a chapel 200 feet below the surface, and the religious statues on either side of the altar as well as the prisms of the chandelier are of pure salt. There are also assembly halls, underground brine lakes and important railway stations and terminals. The various grottoes are named after princes or rulers popular at the time the chamber was being worked, while succeeding generations of miners and their families have elaborated and decorated the old workings. Operations at Wieliczka, however, are crude in comparison to those of American mines.

The oldest salt mine in the United States is the one on Avery's Island, Louisiana, where brine springs were first discovered in 1719. Rock salt was found there in 1862. It is estimated that the deposit consists of over two billion tons of salt. Total shipments to date are under two million tons.

Which Weapons and Tools Will Our Soldiers Require in the Trenches?

BEFORE the present war of the trenches a soldier's equipment was considered fairly complete if it comprised a rifle, bayonet, extra shoes and other articles of clothing, blanket, canteen, and cooking and washing utensils. Most of which went to make a heavy pack which the infantryman had to carry on his shoulders.

With its many peculiarities, trench warfare has vastly increased the collection of weapons and tools which must be at the disposal of the fighters, as is evident from the accompanying view taken in a French trench. Here the *poilu* is seen surrounded by his equipment, which consists of a rifle, grenade-throwing gun, pistol, package of powder for use against gas attacks, grenades in a basket, bag of sand for fighting flame attacks, pick-axe, gun grenades, signal lantern, alarm bell for gas attacks, barbed wire, signal rockets, scoop, corrugated iron, wooden framework or boardwalk known as a "duck board," shovel, huge pliers or cutters for severing barbed wire entanglements, broom, trench periscope, and a magazine rifle equipped with a stand.

While it is true that each individual in the trenches does not require the entire collection of weapons and tools, each trench section has more or less need for all these articles.

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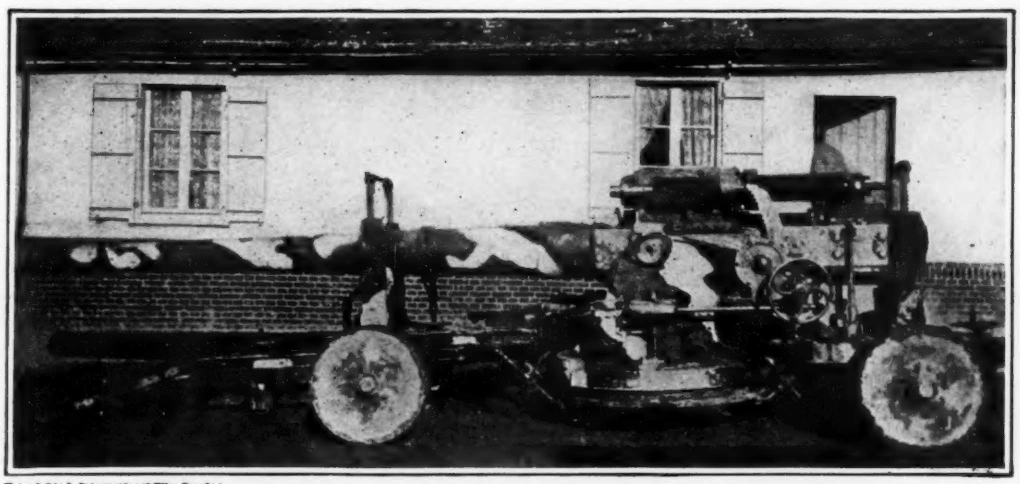
A few of the weapons and tools used by the trench fighters on the French front

Hiding a Big Gun in the Open with a Coat of Spotted Camouflage Paint

THE accompanying illustration is of interest because, at first glance, it appears so indistinct. The initial impression is that it is a mighty poor piece of photography. Yet, as a matter of fact, the photograph is a fair one, and if the subject is indistinct it is due to the application of camouflage paint. Indeed, this photograph is an excellent example of what camouflage can accomplish.

The gun shown is of the long-range, naval type, and is mounted on the usual naval carriage or base. Many guns of this general type are being used by the Allies and the Germans in fixed emplacements along the Western front. The present piece, it will be noted, is merely painted with a spotted camouflage paint, which serves to break up the outlines of the gun and carriage in a most effective manner, while it is being transported on a special truck to its next position. If the camouflage is so effective at a few feet distant, one can well imagine the chances of its being detected by an airman several thousand feet away.



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This is not an indistinct photograph; rather, it illustrates how a gun can be camouflaged by a coat of carefully-selected paints

Washing Railroad Cars by Electricity

SCARCITY of labor brought about by war conditions has caused many labor-saving devices to be introduced in France's industrial life. Power-driven tools of all kinds are being employed in the Republic to an unprecedented extent, and in this manner the shortage of labor has been met to some extent.

One instance of labor-saving devices used in France is the railroad coach cleaner shown in use in the accompanying illustration. This device consists of an electric motor driving a circular brush, the entire equipment being suspended from an overhead beam by a simple tackle, so that it can be raised or lowered to meet the conditions of work. Two types are in use: one, where the electric motor is directly connected to the brush; the other, where the electric motor and its controlling devices are mounted on a board to form a unit, while the brush, driven by means of a flexible-drive shaft, forms a second unit. In either case the equipment is readily handled; and it is said that the hard labor attached to washing railroad coaches is materially lightened for the women car-cleaners.

French women at work as car cleaners, making use of electrically-driven scrubbers

The Current Supplement

THE tremendous pressure that has been thrown on the United States to furnish supplies not only for the great armies we are sending abroad, but also to assist our allies with large quantities of various material and machinery, raises serious questions of production, most important among which are those of labor. An article in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2184 for November 10th, on *Hours of Labor* deals with investigations that have been made in England with a view of securing the best sustained production by the working forces, a matter that will soon be forced on the attention of producers in this country, to whom the experience gained abroad will be valuable. It is also a problem of importance to every student of economics. The problem of evolution is one of absorbing interest to many people, so undoubtedly the article on *The Origin and Evolution of Life*, reviewing a new book by Prof. Henry Fairfield Osborn which deals with certain new aspects of the problem, will be acceptable, especially to many who will not have an opportunity to read the work itself. *The Speed of Ships* discusses conditions determining the most suitable speeds for different classes of vessels, a matter of importance in existing conditions. *Stenographic Machines for the Blind* tells of the principles of construction of machines that will enable men who have lost their sight to take dictations, and so make themselves useful. It is illustrated by several photographs. The paper on *Modern Analytical Chemistry* is concluded in this issue. *Coal Gas for Motor Vehicles* describes and illustrates experiments that are being tried in England with a substitute fuel. *A New Method of Artificially Loading Generators for Test* describes how an important electrical problem is met. It is accompanied by an explanatory diagram. *Radio-Active Halos* discusses some minute rock markings of importance to our views on the physical history of the earth. There are a number of shorter articles of general interest.

France Using Millions of Cast-Iron Shells

FRANCE is making over 1,000,000 cast-iron shells each day according to Edgar A. Custer, an authority. In arguing for the cast-iron as opposed to the steel shell, Mr. Custer points to the superior effectiveness of the iron shells in attacking earth works. He claims that the efficiency of a shell fired against troops is dependent almost entirely upon the character of its fragmentation. In this respect cast-iron shells have been demonstrated to be much more satisfactory than forged steel projectiles. The former also can be made easily in enormous quantities given proper foundry practice. France is making the large numbers cited at present in dry-sand molds. A steel forging for a 4.7-inch shell costs over \$7; a cast-iron shell of similar size can be made for only a little more than \$2. The case of the iron shell seems complete with these advantages, if they can be made under foundry conditions that will insure them to be uniform and satisfactory in quality. To achieve the result Mr. Custer advocates the permanent mold in which he has had wide experience.

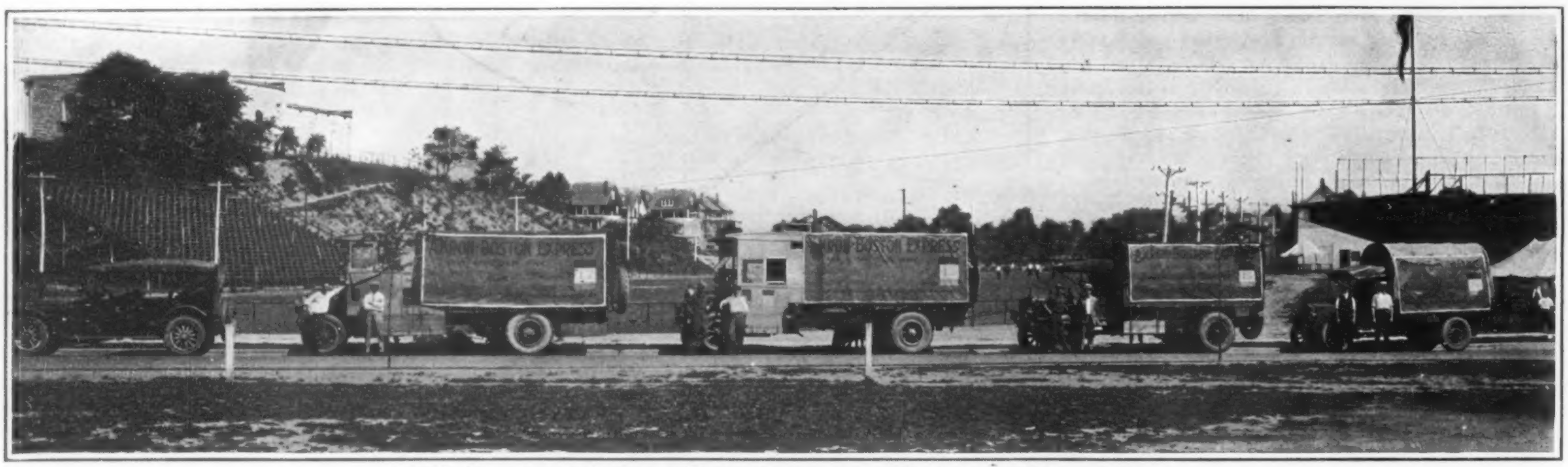
The theory of the cast-iron shell is that, when used against earth works, the greater part of the explosion is not expended in bursting the walls of the shell and the effect is as if the amount of explosive were detonated in the earth work. When used in the open, the great fragmentation of cast iron will allow the shell to burst into a far greater number of pieces than a steel shell and will cover the zone of dispersion very closely.

There is nothing new, however, in the use of cast-iron projectiles. Before the age of steel they were the sole means of battering down defenses and attacking at long range. Some reasons for their being abandoned are that the metal has never had a very good reputation for uniformity and freedom from sponginess and gas holes. Its tensile strength is low and it lacks toughness. Casting in permanent or metal molds is claimed to rectify these and other defects.

Cork Composition as a Heat Insulator

AMONG the virtues of cork is its low conductibility of heat, and a method has recently been suggested by which this property may be made available without undue expense. This consists of a process by which old corks or waste scraps and cuttings may be agglomerated, into a solid sheet which can be used as in insulating bottles, fireless cookers, etc.

According to the French *Review of Industrial Chemistry*, such scraps are first swelled by cooking for several hours in boiling water or in steam and are then agglomerated after being dried by dissolving them in hot nitrocellulose, or else under pressure in a vacuum, in which case the solvent (alcohol, ether or acetone) is afterwards evaporated. The resultant sheets or molded articles can then be impregnated with oils or with a solution of rubber. Another way of preparing cork for this use is to powder it and then mix it with plaster, dextrine and a little water. The paste thus formed hardens in air and can be used as a coating for walls or for receptacles whose contents are to be kept either hot or cold. It can be made more resistant by uniting one part of lime with six parts of plaster, either by tempering them together or by tempering the plaster with lime water. This last mortar can be used to make bricks, tiles, panels, etc. After being made they are soaked in a concentrated solution of sulphate of iron or zinc, which hardens them.



A fleet of four-ton trucks engaged in regular express service between Akron and Boston

History's Lesson to the Motor Truck

Mounting Heavy Loads on Air

By P. W. Litchfield

PENNSYLVANIANS living along the Lincoln Way looked up in surprise one day last spring. They had become accustomed to see touring cars and runabouts whizzing along, where they had formerly seen buggies, market wagons and hayracks. Occasionally also they had seen large solid-rubber tired motor trucks lumbering by. The new object of their curiosity was a large four-ton truck rolling along at touring car speed, on its eight and ten-inch pneumatic tires. It had such a smoothness of motion, that the spare operator in his sleeping compartment behind the driver's seat, had no more difficulty in obtaining a good night's rest than the passenger in an ordinary Pullman berth. After several trips back and forth alone, three more of these pioneer long-distance express trucks joined it to form a fleet, running on regular schedule from Ohio to New England points, and the people along the road began to wonder whether this was a practical thing, and if it was the beginning of a new era in transportation. That is a question which is well worth asking, and I shall endeavor in this article to sketch some of the salient points leading up to the use of the pneumatic truck tire, its present stage of development, and some of the possibilities of its future.

With steel tires the bicycle made but slow progress; the adoption of a solid rubber tire gave it increased public usage, but it was the pneumatic tire which made it a big industry. The use of the solid tire on carriages increased the comfort of riding, but the pneumatic tire allowed the carriage to go so fast with comfort and safety, that the carriage outgrew the horse which became too slow for it, and caused the substitution of the motor.

The automobile was made possible by the pneumatic tire. The internal combustion engine is a delicate mechanism. It has to be geared to the wheels in some form, hence the necessity of a perfect road, or of absorbing the shocks before they reach the wheels. The pneumatic tire performs this function most efficiently. The pneumatic tired automobile replaced the horse-drawn carriage, becaused it saved time, went farther and faster. It increased the amount of travel and increased the distances traveled. I believe the statistics show that now after the few years of its existence, the automobile carries as many passenger miles as the railroads; not that the railroads have suffered any great loss of business, but the increase had been largely created and absorbed by the automobile.

Following the pleasure car came the light delivery truck replacing the horse-drawn truck, largely on pneumatic tires. Then we find the motor truck expanding into larger and heavier fields, still making only an attempt to replace the horse, and equipped with solid rubber tires, which had been practically abandoned on every other form of motor vehicle almost immediately after their adoption. Evidently the tire maker had not kept pace with the development of the truck, or the truck builder was making a mistake. Up to now, the former is probably the correct reason.

One of the express trucks mounted on 12-inch pneumatic tires

It has long been known to the tire maker that compressed air with a durable container is the most efficient cushion and traction shoe for the wheels of an automobile. Also, that the load and cushion are merely a question of the volume times the pressure of the air, and if the volume times the pressure is great enough, there is little fatigue and wear to a properly designed tire casing. The manufacture of practical commercial pneumatic tires jumped from the 1½-inch bicycle tire to the 4½-inch automobile tire in a year or two, and there it has stayed up to the present time. Its limit seemed to be the resistance of close-woven fabric to taking the form of a doughnut and standing the flexing and traction of the greater loads, and greater stretching and crimping given it in the larger sizes. The progress of tire design during the past two years has shown that this limit no longer stands if laminated cords without cross weave are used instead of woven fabric. These cords take the strains without undue fatigue and now we see our way clear to go from 4½-inch cross-section to 12-inch cross-section, as easily as we went from 1½ inches to 4½ inches. It is only a question of study to perfect them to such an extent as to enable the truck to repeat the remarkable growth of the pleasure car. Pneumatic tires up to 9-inch cross-section are now in successful commercial use on trucks and passenger busses. The speed and distance of the vehicles have been increased and up-keep costs reduced. It may be that the tire cost per mile is higher than with solid rubber tires, but the same is also true of pleasure cars. A solid tired touring car would have a tire mile cost of less than half that of pneumatics, but all other costs—fuel, upkeep and depreciation—would be higher.

The first trucks designed for solid tires were lighter than those in use today, but the vibration caused so much breaking of parts, that they have been strengthened and reinforced repeatedly. This can all be saved by using penumatics, allowing lighter chassis and bodies to carry heavier loads. Also the traction of large single pneumatics is much greater than that of solids, permitting the operation of the trucks in

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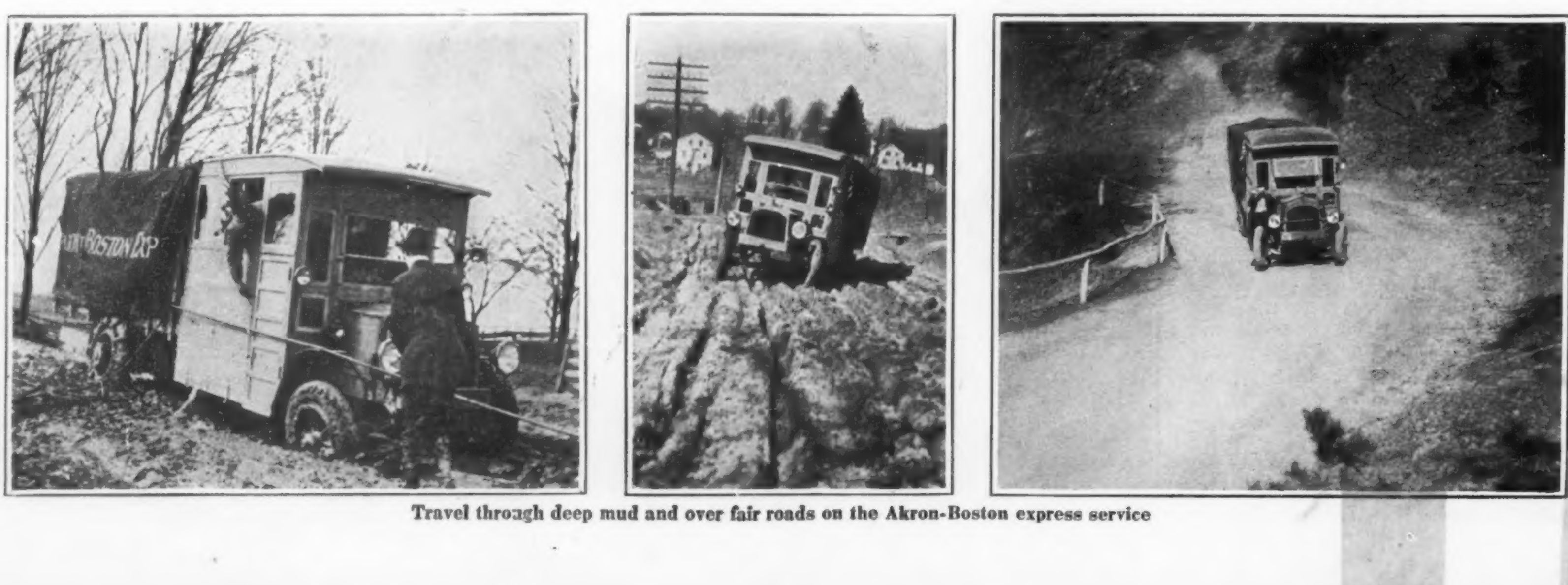
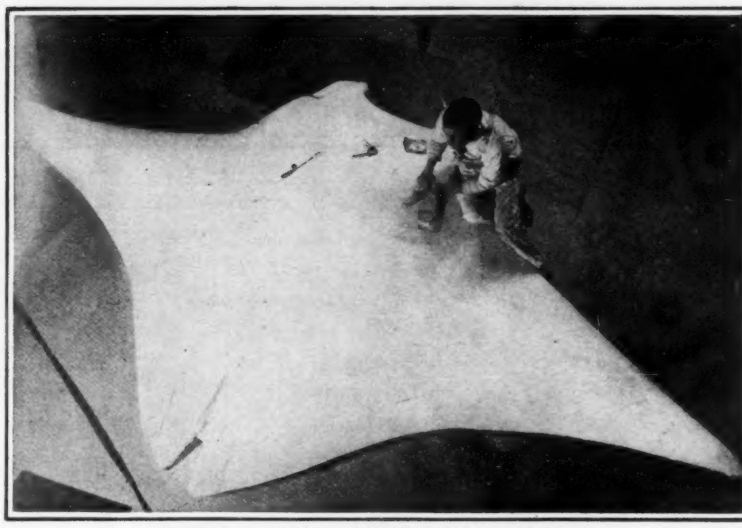


Travel through deep mud and over fair roads on the Akron-Boston express service

The Greatest Devil-Fish

THE largest *Manta Birostris* on record, a monster female 18 feet long and weighing 6,000 pounds, captured and slain after a terrific battle off the southwest coast of Florida, is now being placed on exhibition at the Museum of Natural History, New York.

Though the devil-fish is of tremendous strength and great vitality, death is instantaneous when the spinal cord is severed at a point just back of the brain. The wonderful vitality of the creature, however, is well known, and there are many instances of its having escaped after being harpooned, lanced, and shot many times with rifles of heavy caliber. In starting to hunt this specimen a most effective weapon was required. A huge lance was forged, more than three times as heavy as a whale lance, and having a square cutting edge four inches wide. It was also necessary to devise means to bring the creature to close quarters as soon as possible after harpooning. For this purpose a drag of thick timbers, large enough to stop the first rush of the harpooned fish, was employed. A rope with heavy knot at the end is passed through both pieces of timber, the knot holding the rope at the end of the thicker beam, and the other end of the rope being attached to the harpoon. The great resistance of this as it is dragged through the water wrenches the harpoon so severely when the fish rushes that the animal is soon brought up short.



Preparing the largest devil-fish for exhibition

The craft used in hunting the big devil-fish was a 26-foot, open boat, with an eight-horse-power gasoline engine. Besides the leader, the crew consisted of five trained native fishermen, expert in handling the boat and without fear. When all was ready the boat passed out through Captive Inlet into the waters of the Gulf. Shortly the dark form of a huge devil-fish was seen. It was on the surface, and the boat moved to the attack. The big creature proved to be a female, swimming on or near the surface with her mate following.

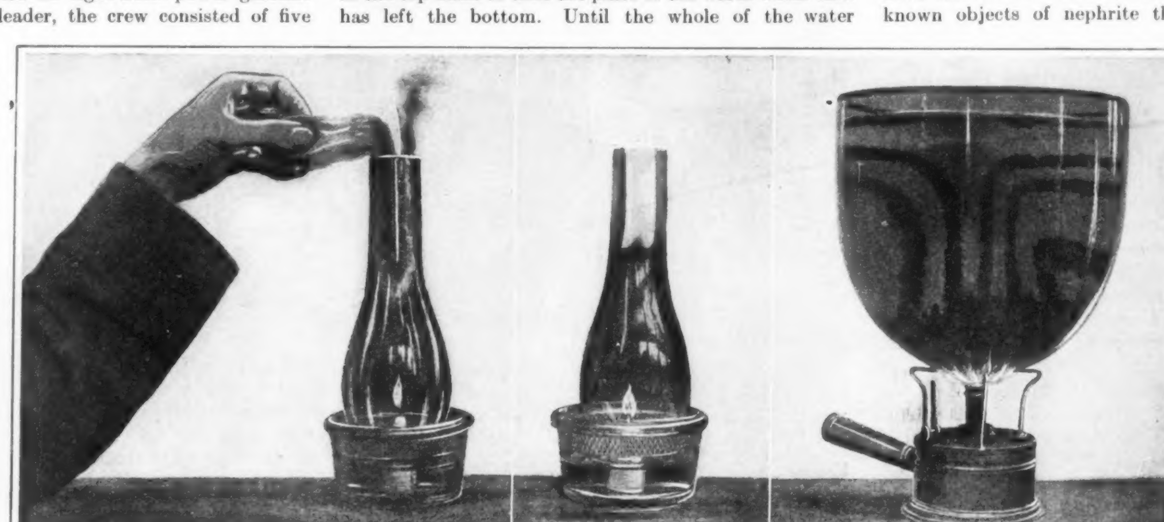
As she was passing, quartering across the bow of the boat, the harpoon was driven deep into her broad back, then, with a great splash of her fins, she plunged below and ahead. The drag was snatched under and the shock was so great that it brought the devil-fish to the surface, making awkward leaps after the manner of a wheel turning over sideways. The harpoon was hurled again and the fish disappeared beneath the surface. Soon the wounded monster was seen again, however, charging down on the boat at full speed. Instantly the harpoon was put out once more, but the vital spot was missed by a few inches. The big drag kept the fish always near the boat, and she made repeated short rushes to the surface, accompanied by violent blows from the huge pectoral fins.

To escape being capsized and sunk by these, as the enraged and wounded creature reached the surface the boat was steered onto her back. In this position, while being actually towed upon the back of the great fish, the lance was driven home again and again. Afterwards a dozen rushes were made by the devil-fish to the surface, but each time the boat was maneuvered upon her back and the harpoon applied. This thrilling and dangerous fight lasted only 22 minutes, but the dead devil-fish showed 23 wounds when examined.

The color of the Manta is black, and it has a short thick rigid tail, flexible only at its origin. While feeding they go alone, moving slowly and turning from side to side with constantly moving cephalic fins, which are used almost like a hand to seize the food and convey it to the mouth. Here it is crushed by a formidable array of large molars, perfectly flat, and admirably adapted to their owner's needs. The Manta exhibit little fear of either man or boat, and thus offer exceptional advantages for close range observation.

Demonstrating Convection Currents

A VERY pretty experiment is possible to demonstrate convection currents in a liquid. For the purpose a glass vessel with a round bottom should be secured. Fill this with water and place over a small spirit flame. Finally throw in some solid coloring matter, such as an aniline dye, and watch the results. The water nearest to the flame is soon heated; as a consequence it expands and becomes lighter. It therefore rises and in doing so carries with it streams of bright color. The cold water at the top sinks to take the place of the warm water that has left the bottom. Until the whole of the water is heated there is a constant interchange of these currents, with the result that most striking effects are secured.



Right, making convection currents visible by means of colored sediment. Center, dividing a chimney into two flues; Left, demonstrating that the draft is downward through one of these and upward through the other

It is almost as easy to show the convection currents in air. Put a short piece of candle in a saucer of water, light it, and place a lamp chimney over it. The chimney interferes with the free interchange of air, and the candle soon goes out. Cut a bit of card in the manner shown in the photograph and insert the lower portion into the chimney, dividing the latter into two sections. Now light the candle again; this time it burns brightly. The direction of the convection currents can be easily shown by holding a smouldering piece of brown paper over the chimney. It will be seen that the smoke travels down one side of the piece of card and up the other.

A Monster Gem

THE accompanying photograph shows the largest boulder of jade, or nephrite, ever mined. Weighing 4,710 pounds, this noteworthy mass is of exceptional interest from the fact that it is likewise the largest surface of jade that has ever been polished. The immense boulder, seven feet long, two feet wide, and one foot thick, has recently been placed on exhibition in the foyer of the New York Museum of Natural History. It was found at Jordanamuhl, southwest of Breslau, Germany.

The quarry was in the form of a low bowl-shaped hill about 75 feet high and 2,000 feet long, of which more than two-thirds had been removed during the past 20 centuries, the material having been used for roads, house foundations, bridges, etc. In one side of this hill was noticed a large protuberance, greenish in color, which, upon breaking off a few splinters with a hammer, was found to be nephrite. The question of blasting was not to be considered, owing to the strict German regulations as to the use of dynamite. By use, however, of a lever drill, made by embedding a heavy crowbar in a log about twelve feet long and six inches in diameter, it was possible for a dozen men to pry loose the mass. Afterwards the boulder was shipped to America. As this huge block of jade is large enough to have furnished more than enough material for all the known objects of nephrite that have been found in Europe, it is clear that the prehistoric jade objects need not necessarily have been brought in during migrations from the east, as had been formerly supposed.

Although both are comprised under the common designation jade, nephrite and jadeite are mineralogically distinct, the former being a magnesium-calcium silicate, the latter a sodium-aluminum silicate. They are, however, more or less similar in general appearance. The source of jadeite in our day is Burma, where it is mined in considerable quantities to meet the Chinese demand. It is notably harder than nephrite, and ranges in specific gravity from 3.20 to 3.40, whereas the average for nephrite is but 2.95. Nephrite is cut into vases, cigarette cases, cigar boxes, candlesticks, portrait frames, and other art objects. The rich green color and translucency make it peculiarly appropriate for such uses. Jade has been found in Alaska, about one hundred and fifty miles up from the mouth of the Kowsk River. With the notable mass of jade here pictured, and another large water-worn boulder from South Island, New Zealand, donated by the late J. P. Morgan, the exhibit of the American Museum of Natural History holds first rank among the jade collections of the world.

The largest bouldeı of jade in the world

Manufacture of Vaccines in China

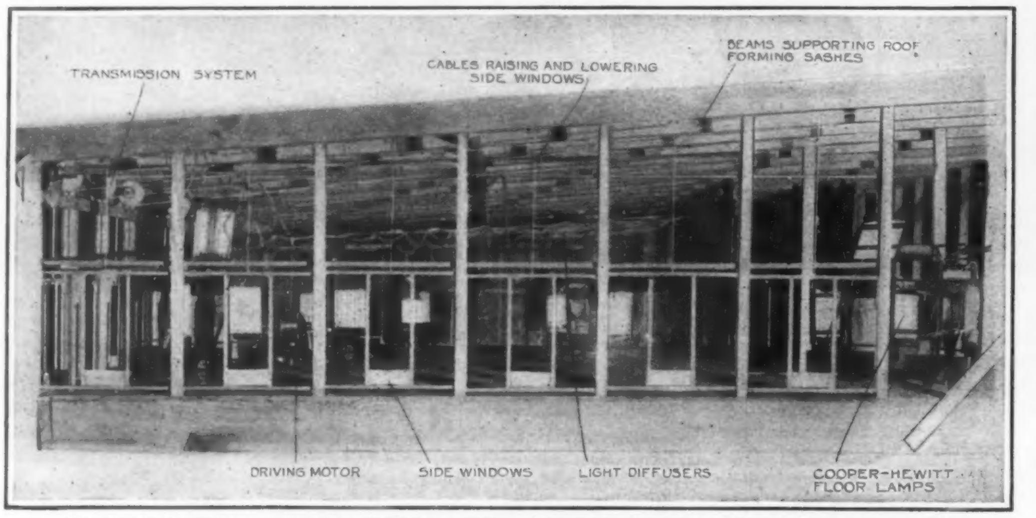
THERE are at present in China four laboratories for the manufacture of vaccines, while preparations are under way for the establishment of a fifth one, at Peking. The laboratory at Hong Kong manufactures smallpox, plague, typhoid and other bacterial vaccines. In Shanghai there are two laboratories—one conducted by the municipality, and manufacturing smallpox, typhoid and other vaccines, and the other a small laboratory manufacturing smallpox vaccine only, and conducted by a Japanese firm. The municipal laboratory, aside from manufacturing vaccines, also administers the Pasteur treatment for rabies. A fourth laboratory is located at Nanking, and manufactures smallpox vaccine. This vaccine is sold in Nanking and vicinity at a price approximating five cents, United States currency, per tube.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A Motion-Picture Studio Which Changes with the Weather

THE problem of safeguarding the production of motion pictures in open air is an important one, especially in the instance of sunlighted studios which must not only be protected against wind and storm and rain, but also against darkness. To this end Mr. Isadore Bernstein, head of a film producing organization of Los Angeles, Cal., has applied himself for several years with the result that he has evolved an outdoor studio that may be instantly converted into an enclosed, storm-proof studio to meet the fickleness of the weather. The manipulation of a switch not only converts his studio into a wind- and rain-proof enclosure, but it also provides artificial light under the same conditions as sunlight so that no new arrangements or manipulations are necessary in this particular.



By simply throwing an electric switch this motion-picture studio can be changed from an open-air to a closed-in structure

The value of Mr. Bernstein's invention can only be appreciated after a study of the business of film producing. This business is unlike any other business: expenses go on whether a company is producing or not, so long as it is organized for work. Great sums are expended for the arrangements of productions, and large casts are at hand; yet any delays due to clouds, wind, rain or poor light, suspend the work and hence result in heavy losses to the producer. Particularly are these losses severe when the scenery must be removed from an exposed stage and later moved back and erected again; and should the stage carpenters fail to match the scenery with the previous arrangement—which is obviously very possible and usually the case—the continuity of the production is ruined and the scenes previously made must be taken over.

Now in the studio designed by Mr. Bernstein all contingencies are said to be taken care of. Should the weather conditions suddenly change while the work is in progress, it is necessary only to start an electric

(Concluded on page 355)

Sampling Tubes to Protect the Farmer

NO doubt it was some thrifty and cautious farmer who originated the saying about the folly of buying a "pig in a poke." The principle of paying out hard-earned cash for some commodity of doubtful value is fast disappearing; not only is a guarantee required when a purchase of any importance is made, but the buyer demands to be shown just what he is getting before he parts with his money.

Taking a sample plug from a bale of hay

A novel device has been produced for taking samples of material rather difficult to test, namely baled alfalfa hay, bean straw, etc., and also manure in bulk.

These commodities are sold by the ton, as a rule, and it is a matter of considerable importance to the agriculturist who is buying a carload of fertilizer or mulch to learn whether he is paying for a large or small proportion of water. For example two materials used as mulches were tested and found to vary widely in their water content. One of them contained 15 per cent of water on the basis of its dry weight, while the other contained 152 per cent, or ten times as much. Obviously it is essential for the buyer to know how many pounds of water he is paying for when he purchases a ton of mulch or manure.

A sampling tube has been developed by Mr. Frank F. Chase of Riverside, Cal., for this purpose. Two sizes are in use, a large one for taking samples from carload lots of manure or similar material in bulk, and a smaller one for use with bales of alfalfa, cornstalks or bean straw.

The larger size is six feet long and two inches in diameter and is provided with a tempered steel cutting edge with projections like rounded saw teeth. At the upper end, a ring is welded to the tube to strengthen it, and a handle is provided which extends across it at right angles. In sampling a carload of manure, the tube is forced into the mass, with a twisting motion that cuts a core and leaves it in the tube. After reaching a depth of a foot, the tube is withdrawn, the sample removed and placed in a testing can, and the operation is repeated in the same place to a greater depth. The samples are weighed wet and after being thoroughly dried are again weighed, the difference representing the water content. Thus the percentage of water in the entire load can be readily determined.

The smaller tube for taking samples from baled material, has a length of three feet, but is otherwise the same as the larger one. The method of obtaining the percentage of water is the same in both cases; weighing when first removed and comparing this weight with the results after the samples have been through the drying oven. This test would also indicate whether the quality of the material was the same throughout the bale, a matter of interest in some cases.

Speeding Up the Work on Auto Crankshafts

"WE will shortly require 3,000 crankshafts per day and we have got to have them."

Suppose your production manager put it up to you in that way, like an ultimatum or ukase, and meant it. If you were built similarly to a certain Detroit engineer who has charge of the purchasing of equipment for machining these crankshafts, you would naturally do as he did. He separated the machining operations into groups, such as turning, facing grinding, drilling, reaming and so on. Then he called into consultation various manufacturers and specialists in the building of machine tools for grinding, drilling and reaming, and he grew confidential.

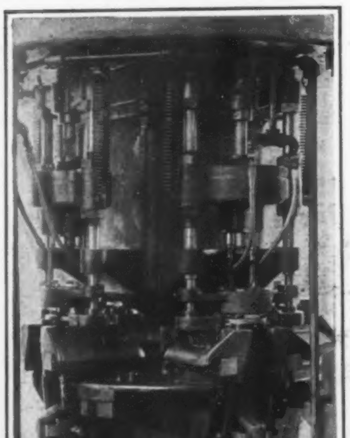
One of the results was that a special machinery builder designed and constructed the machine shown in the accompanying illustrations, for the single purpose of drilling and reaming six holes in the flange of the crankshaft, at a production rate of one shaft per 50 seconds. This machine, while intended for the automobile manufacturer's special needs, is similar to other station machines in general and detailed construction.

The crankshafts to be drilled and reamed first go to station No. 1, where the operator loads and unloads them. At the operator's right is a "start-and-stop" electric switch which controls the five-horse-power motor mounted on top of the machine and used to drive it. Below the switch is a hand-lever which controls the feed action of the heads. All bearings are automatically lubricated and the oil feed glass is in constant view of the operator.

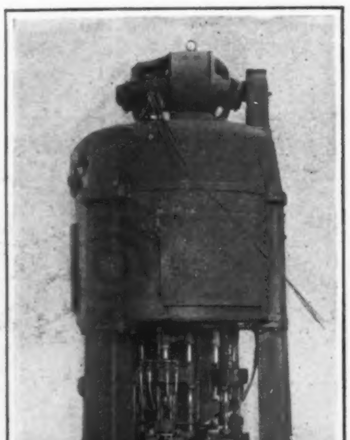
Stations Nos. 2 and 3 are shown in another illustration, which is a near

(Concluded on page 355)

Station No. 1, where the operator loads and unloads the crankshafts



Stations No. 2 and 3, where the crankshafts are drilled and reamed



Station No. 4, where the four bolt holes in the flange are drilled

The machine which speeds up work on automobile crankshafts, as viewed from different angles

Inventors Whom I Have Known

(*Concluded from page 347*)

national as well as individual importance. He was the owner of letters patent in both hemispheres, but his rights were challenged, as might be expected, and would have to be fought for in the British courts of law. Very naturally I was willing to undertake this business.

The next day I met Alexander Graham Bell for the first time. His appearance—tall, straight, with dark hair and eyes, of self contained and prepossessing demeanor—made a most pleasant impression on me. The following evening I went to his house, and was witness to an experimental demonstration of the wonders of the telephone.

The first point was to get a few instruments set at work in City of London offices. I assured my American friends that no difficulty would be met here. I little knew my countrymen. Several of the firms to whom we went hesitated, and were inclined to draw back, taking themselves to be granting, not receiving favors. However, we had no difficulty in high places—both in society and in government circles. Telephones were soon installed in the old Queen's palace at Osborne in the Isle of Wight, as well as in various ministerial headquarters. The wires were carried from the palace at Osborne into my own room in my city of London offices. It was with wonder that a small group listened for the first time to "Home, Sweet Home," to "Annie Laurie" and other familiar strains, played on a cornet in Osborne House.

The news of the great invention spread rapidly, both among scientific and business people. It was received with amazement, if not incredulity. At any rate, when the Society of Arts opened their large hall in the "Adelphi" to the inventor, it was crowded to the doors.

Waiting the lecturer's arrival the guests were eagerly studying the models and pictures, and the hum of voices filled the room. Instant and almost painful silence prevailed when the young inventor appeared on the platform. In an even and pleasant voice he began his task. So many years ago, production of sound by vibration controlled and developed by natural or artificial means and the transmission by wire of sounds so produced, and the use of the electric battery to excite those vibrations, were topics utterly novel to nearly every auditor in that room. Even a new vocabulary was being used. Receivers and transmitters and diaphragms, and all the rest were not then the household words that they have since become.

Still, the lecturer was not talking in an unknown tongue, for he possessed then as ever the gift of simple and pleasant speech.

The lecture having been brought to a close in a hurricane of applause the audience broke up into groups, many seeking introduction to this new prophet of a discovery of obvious and tremendous consequence in the worlds both of the home and of the market place.

More than one suit was tried shortly in the courts to support the validity of the Bell patents against infringement. They were sustained in every instance. The telephone soon became a familiar object in the office, the factory, and the household. But neither in Britain nor in any other European country, as I understand, has the telephone come into the universal use that it has attained on this continent.

History's Lesson to the Motor Truck

(*Concluded from page 350*)

sand, mud and snow, where the solid tired trucks would be stalled. The gasoline and oil consumption is much less with the pneumatic tire. The motor truck so far has only attempted to replace the horse in hauling merchandise, as the solid tire has so limited its speed that it could not compete with any form of transportation requiring long hauls at higher speeds. When it can accomplish this, it so enlarges its field that it becomes a real competitor of the railroads.

Here lies its future and an analysis of some of its advantages over steam and rail transportation are in order. The same forces which operated in favor of the rail-

roads, as against the rivers and canals are now operating in favor of the pneumatic-tired motor truck as against the railroads. With the advent of the railroad, cities no longer needed a harbor to become great, nor even a navigable river. The growing population followed the railroads, and towns which were located on a railroad grew to be cities, while their neighboring towns stood still or went backward. Railroads are expensive to build at best, and hence they picked out the routes of easiest grades and fewest curves regardless of the fertility of the soil and climatic conditions. The people gathered along the railroads and the value of the lands far from the tracks remained low and their population scarce, owing only to the handicap of lack of economic transportation. Now comes the automobile to solve the problem. It enters the field not as a cheaper form of transportation, but as a faster and more flexible form, and those who can afford it, immediately take advantage of it. They leave the congested city and seek homes outside. Here they find land cheaper and get larger pieces of it, equalizing the higher cost of transportation by lower cost homes with better living conditions. This has the effect of increasing land values, supporting a larger population and increasing the volume of transportation. Volume production of automobiles follows, lowering the cost and more and more people take advantage of this to go out to the country. The people now being farther apart from each other and from the supplies and merchandise which they need, the greater becomes the volume of transportation. They are now farther away from the railroads than before; their supplies must be brought to them either by extending the railroads or by the use of motor trucks, which will depend on the best combination of time and cost. It costs so much to build a railroad that in order to get the capital necessary a franchise has to be granted giving a monopoly of the business and allowing a charge for transportation to absorb this and often such a handsome profit as to establish a franchise value in excess of the actual cost. The public is now not inclined to grant a monopoly to a private corporation if it can avoid it, so that since the advent of the motor car, it is more receptive to spending money on good roads which all can use at will, rather than granting a monopoly to railroads. The automobile has decreased the economic necessity of being located on a railroad and every extension of motor vehicle use will still further emphasize this. Where population is scarce, the motor can reach it with a relatively small capital outlay, which would not justify the building of a railroad. This would open the land to use and the automobile naturally inherits the traffic. This great increase in volume of transportation by opening additional lands to increased habitation is the principal reason why the passengers per mile carried yearly by motor now exceeds the amount carried by rail, after these few years of the motor car industry, without any appreciable falling off in the business of the railroads.

One of the greatest assets in favor of the motor truck is the reduction of transfers of goods from one car to another. The cost of construction and maintenance of way of a railroad, limits the lines, while the motor is constantly taking more people and business places away from the railroad tracks. This results in increased handling when the railroad takes only part of the haul. Just as the railroad at higher cost can compete between places not far from the coast, by absorbing the higher long haul cost between the ports by the saving in time and cost of transferring of the short hauls at each end, so can the motor truck do this between two establishments or houses near, but not directly on the railroad. Furthermore, the absence of dependence on a fixed terminal relieves the congestion of traffic and saves tie-ups for the motor truck as against the railroad.

In order that the motor truck shall make the most of its advantages, it must make higher speeds.

The immediate step to accomplish this,

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is the use of the pneumatic tire, followed by the changes in truck design which will naturally follow. Then schedules should be established for the operation of the truck both night and day; the greatest speeds can be obtained at night when the roads are relatively free from other traffic. The organization of large companies capable of covering the traffic problems of large blocks of territory will follow, cutting out the wastes and eddies, and bringing about the scientific organization of the traffic on economic lines.

Another use of the pneumatic tired truck, which is of immense importance at the present moment, is its efficiency for military purposes. Doubling and tripling the safe running speed of the truck as against solid tires, cutting down dead loads, increasing carrying capacities, multiplying the mileage per day, and lessening the time of the truck in the repair shop. This will make possible performances even more effective than parts played by the motor vehicle at the Battle of The Marne, and supplying the French army at the Siege of Verdun. The success of an advancing army is dependent on the speed with which its supplies can be moved.

Any form of transportation which saves time, shortens distances, and furnishes elasticity of operation, makes for economy and reliability. Surely the pneumatic tired truck possesses these elements to a greater degree than any other form of merchandise transportation heretofore known, and in the race of the survival of the fittest, has a lead which no other form of surface transportation now known can overtake.

Looking into the matter of costs, it almost seems as if science and nature were working hand in hand. The invention of the internal combustion engine and pneumatic tire, found the world's supply of liquid fuel and crude rubber entirely inadequate for any great-sized industry. Both soon reached what seemed to be prohibitive prices, but new sources of supply were found. Rubber, which since its first use had only been obtained from the wild jungle at enormous cost of lives and money, was successfully cultivated. Now this indispensible raw material of transportation can be grown at one-quarter of its present selling price in unlimited quantities in that part of the globe where land is most productive and population most dense. This not only gives added employment to dense peoples of the Orient, increasing their productive value, bringing civilization and better living conditions to them, but the product of their labors go to increase the productive value of distant lands and to support an increasing population there also. Truly this all seems a part of the slow unfolding of God's plan for meeting our needs and problems.

A Motion-Picture Studio Which Changes with the Weather

(Concluded from page 352)

motor which actuates a telescopic arrangement of sliding windows on the top and the sides of the structure, effectually shutting out any danger from the elements. The driving motor operates in either direction, and a set of cables opens and folds the windows like the segments of a collapsible drinking cup or telescope. The operation of this mechanism in no way interferes with the settings of the stages, which may be placed quite close to the sides of the structure, if desired.

The designer's plans include a system of adjustable light diffusers adapted to regulate the lighting effects whereby the natural light of the sun can be varied or artificial light modified. In addition, the diffusers prevent the supports of the collapsible roof from throwing shadows upon the scenes or studio floor. The light-diffusing system is made up of a series of sliding shades which travel upon wires. The shades, usually of thin goods suitable for the purpose, may be drawn out of the way when not needed or may be extended the full length of the over-structure when it is necessary to close out completely or partially the rays of the sun from the top. Coöperating with the diffusing system is an arrangement of roof-forming sashes which are fitted in grooved guides running parallel to each other. The electrically-driven cables either draw the sashes one over the other until the groove is filled, or fold them back again when the sunlight is to be used. The same operation of the cables raises or lowers the side sashes in the walls of the structure.

The artificial lighting system consists of roof and floor lights. Lamp sockets are inserted at many points below the flooring in different parts of the studio, with covers that lie flush with the surface when the lights are not being used. Light can, in this manner, be thrown from the floor upon any set or scene placed on the studio floor.

In the event of a storm, the director making use of a studio designed along the lines suggested by Mr. Bernstein, who will be remembered as the builder of Universal City, the only motion-picture city in the world, has but to switch on the electric current whereupon the structure is automatically converted into a closed-in studio; and, what is most ingenious, the artificial lights which are then flashed on use the same system of diffusers as were employed with the sunlight, so that conditions are virtually the same as before the appearance of the passing storm or darkness.

Speeding Up the Work on Auto Crankshafts

(Concluded from page 352)

view of a crank-shaft supported vertically on centers and held in fixtures. These fixtures are free to float universally, in order to line up correctly with the heads each time after the table has been indexed. At station No. 2 the two pin holes are drilled, and at No. 3 the holes are reamed. Flexible tubes convey cutting oil to the tools by means of a pump mounted at the lower left of the right-hand column, and near the latter is a relief valve shut-off and the general piping arrangement. The fourth station appears in another view, and it is here that the four bolt-holes in the flange are drilled. One operator takes care of all the stations from his stand in front of No. 1.

Wireless and New York's Police

(Concluded from page 344)

mediately taken care of. When the boat is at the pier, it is sent to investigate; and when it reaches the scene of operations its commander sends a report of the case by wireless to the radio man at Headquarters, who in turn telephones it to Harbor A. When the boat is away from the pier, such messages are given to the wireless operator at Headquarters, for immediate transmission to the boat.

Through the courtesy of Sergeant Pierce, who is in charge of the wireless system, we have been able to study parts of the log of the Police wireless. There are numerous instances on record which prove conclusively the value of the system, and from hundreds of cases the following have been selected because of their general interest.

On May 18th, at 4 a. m., two barges broke away from the pier at the foot of East 54th street, Manhattan, and, driven by a strong wind and tide, swept up the East River and carried three more barges away from the 70th street pier. The five barges drifted out through Hell Gate, in the path of the fleet of steamers that comes in through Long Island Sound early every morning. The "Patrol" was off Staten Island when this information was forwarded by Manhattan Headquarters wireless station, about four o'clock, and at 5.35 a. m. Sergeant Ellis, in command of the "Patrol," reported by wireless having found and docked four of the barges, and that the fifth had been secured by a tug. But for this prompt action, one can well imagine what might have happened if the Long Island steamers had run into these derelict barges.

On May 21st, at 1 a. m., a fire occurred in the Metropolitan Hospital on Blackwells Island The "Patrol" was cruising around the lower bay, and was ordered by radio to the fire, and to stop at East 51st street pier for the Battalion Fire Chief. When the fire was extinguished, wireless

orders were given the boat to resume patrol.

On June 5th, at 4.35 p. m., the Brooklyn Telegraph Bureau was notified by a citizen that a motor boat off Manhattan Beach was flying distress signals. The Brooklyn wireless operator sent the message to the "Patrol," which was off the Navy Yard and immediately started to the rescue. At 5.16 p. m., the commanding officer on the boat inquired by wireless if any further information had been received, and the Brooklyn Bureau, after communicating with the citizen who reported the matter, sent the following message to the boat at 5.28 p. m.: "Party in motor boat off Manhattan Beach still waving white flag. Coney Island Life Corps tried to reach them and failed." The "Patrol" reached the location at 6.15 p. m., just as the launch was taken in tow by a fishing steamer.

On June 13th, at 10.30 p. m., a citizen notified the Richmond Telegraph Bureau that a large transatlantic steamer was sinking, after a collision with another boat in the Narrows. The "Patrol" was ordered to the scene by wireless, and at 12.15 a. m., forwarded a full report of the accident to Headquarters by wireless, which was telephoned to Harbor A.

On June 20th, at 9.40 p. m., Harbor A was notified by the pier watchman that a lighter had broken away from the West 30th street pier, and was drifting up the river. The "Patrol," off the Statue of Liberty, was notified by wireless. At 10.15 p. m., the "Patrol" reported by wireless that the lighter, carrying a cargo of coffee valued at $50,000, had been returned to the pier. But for this prompt action there would, in all probability, have been $50,000 worth of coffee at the bottom of the Hudson River.

On July 4th, at 6.45 p. m., Harbor A was notified by a citizen of a tug going up and down the East River apparently not under control, as it had collided with other boats. The "Patrol" was sent to investigate and found that two intoxicated boatmen had stolen the tugboat "General I. J. Wistar" from a pier in Brooklyn, and were having a "joy ride." The men were arrested, and the case reported by wireless at 7.50 p. m. The tug was returned to the owners, only slightly damaged.

On July 13th, at 1.50 p. m., trouble on a steamship anchored in the harbor was reported by telephone to Harbor A. The "Patrol" was sent to investigate and it was found that a member of the crew of the steamship had been seriously stabbed during a brawl. A wireless message for an ambulance to meet the "Patrol" at Pier A, was sent to Manhattan Headquarters at 2.10 p. m. The injured man was brought ashore at 2.20 p. m., and sent to the hospital in the ambulance which was waiting. He subsequently recovered, thanks largely to the prompt medical care—and wireless.

The foregoing are but a few typical instances of the use of wireless by the New York Police Department. Of general interest too is the fact that the "Patrol" has also met at Jersey City and brought to Manhattan, each of the six foreign commissions that have visited the city during the summer. On these occasions, use of the wireless between the boat and Headquarters enabled the city officials to keep in close touch with the movements of the parties. When a train with the Commission was late, Headquarters was informed by wireless from the boat, which was waiting at Jersey City. And when the party boarded the boat, a wireless message to Headquarters was telephoned to the Inspector in charge of the line of parade, so that the route could be cleared in time and with the least interruption of regular traffic.

Altogether, about nine hundred separate messages have been exchanged between the three police wireless stations during the past six months. All these messages have to do with a wide range of work. And all this work is to be found in the regular routine of police duty. So, if wireless has proved practically indispensable for this class of work, we can imagine in a small way how invaluable it would be if the usual means of communication were rendered imperative by a catastrophe.

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